Use

These specifications set out the Christchurch City Council technical requirements for the construction of land and asset developments undertaken both on behalf of Christchurch City Council or that are intended to be taken over or maintained by Christchurch City Council.

The Infrastructure Design Standards set out the technical requirements for the design of land and asset developments. As such, there is a degree of interrelatedness between these two documents and they should be read in conjunction with each other.

While all possible care and effort has been taken in the development of the CSS, these documents relate to situations, practices and procedures that are likely to change.

Christchurch City Council accepts no responsibility for failure in any way related to the application of these standards. They should not be deemed as providing either the formal or the only answers to any particular situation or set of circumstances. Therefore, they need to be considered and applied with due care and forethought and should not be relied on in isolation from other sources of advice and information.

Controlled document

These specifications are controlled documents. The registered holder of these documents shall be responsible for ensuring that all authorised amendments are incorporated into this controlled document as they are issued. The holder shall ensure that the Amendment Register is kept up to date and the specification is therefore the correct issue, as referred to in any contract documents.

Amendments can be emailed to the registered holder, along with the method for obtaining hard copies of the amendment. To obtain amendments by email, subscribe to the email address list. Send an email containing the following information:

In the ‘to’ box css@ccc.govt.nz

In the ‘subject’ box subscribe to Infrastructure Standards

Please include your name in the body of the message
This process is also set out at
www.ccc.govt.nz/business/constructiondevelopment/constructionstandardspecificatio
n.aspx.

The CSS is available to be viewed, and downloaded in PDF file format, from the
Christchurch City Council website at:
www.ccc.govt.nz/business/constructiondevelopment/constructionstandardspecificatio
n.aspx.
This website will always contain the current document.

Register

Please fill out and return the registration form on the following page.
TO: City Environment Group Business Support team
    Christchurch City Council
    PO Box 237
    Christchurch

RE: Construction Standard Specifications

Controlled Copy No:

Issue Date: 1/04/13

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CHRISTCHURCH CITY COUNCIL

CONSTRUCTION STANDARD SPECIFICATION

PART 1 – GENERAL

CSS: PART 1 2013

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1.0 FOREWORD

This Specification forms Part 1 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General  
CSS: Part 2 2013 - Earthworks  
CSS: Part 3 2013 - Utility Drainage  
CSS: Part 4 2013 - Water Supply  
CSS: Part 5 2013 - Lights  
CSS: Part 6 2013 - Roads  
CSS: Part 7 2013 - Landscapes

Each Part of the Standard Specification includes those Standard Details (SD) relating to that part of the specification only. The Standard Details are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

Christchurch City Council RMA92019127 Global Consent for Works Affecting Protected Vegetation
Christchurch City Council Guidelines for Entering and Working in Confined Spaces
Christchurch City Council Schedule of Local and Special Conditions to the National Code for Utility Operators’ Access to Transport Corridors 2013
Code of Practice for Temporary Traffic Management (CoPTTM) 2012
Local Roads Supplement to CoPPTM (LRS) 2009
NZS 3910: 2003 Conditions of contract for building and civil engineering construction
NZS 4402:1986 Soil testing for engineering purposes
NZS 4407: 1991 Methods of sampling and testing road aggregates
NZS 4454: 2005 Composts, soil conditioners and mulches
NZS 6803: 1999 Acoustics – construction noise

Transit New Zealand Specifications
New Engineering Contract Edition 3 (NEC3)

Occupational Safety and Health Service Guidelines for the Management and Removal of Asbestos Revised January 1999


NZQA Unit Standard 25832 Use a nuclear density meter to measure compaction of soils, sands and gravels

3.0 DEFINITIONS

The following definitions apply in the CSS, unless inconsistent with the context. These definitions are additional to those definitions in the City Plan and the IDS.

Engineer as defined in NZS 3910 “Conditions of contract for building and civil engineering construction”. (Note this is different from the Engineer as Professional Advisor definition in IDS: Part 1 – Introduction.)

Qualified arborist a person who is in possession of a recognised arboriculture degree, diploma or certificate, and on the job experience, is familiar with the equipment and hazards involved in arboriculture operations, has demonstrated proficiency in inspecting, analysing and treating hazardous trees and has demonstrated the ability to perform the tasks involved. A Certificate as referred to in this definition shall consist of a minimum of 240 New Zealand Qualifications Authority credits of learning (i.e. Level 4) or equivalent.
4.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

Selected materials are specified in this document.

Council prefers that sustainable business practices and materials be used for Council infrastructure. To help achieve this, Council will be incorporating a tender attribute reflecting the incorporation of sustainable materials and processes. Contractors demonstrating sustainable practices will receive credit through the attribute assessment as part of the tender analysis process.

These practices could include utilising materials that contain a recycled component or that are able to be recycled at the end of their life or by proposing processes with reduced environmental impact e.g. drilling pipes as an alternative to open trenching.

Approved laboratories are IANZ accredited to carry out the particular test being requested.

5.0 QUALITY ASSURANCE

5.1 Quality Plan

All Project Quality Systems and the Contract Quality Plan shall comply with IDS: Part 3 - Quality Assurance, as specified.

Where the Contractor is responsible for aspects of design, the Project Quality System shall also cover details of this.

Examples of Compliance Requirements Checksheets are appended to each part, where available.

5.2 Personnel

Personnel shall comply with the requirements of IDS: Part 3 - Quality Assurance.
5.3 Reporting

Records of testing and maintenance inspections shall comply with the Contract Quality Plan, including the interval of supply. Further information is available in IDS: Part 3 - Quality Assurance.

5.4 Audits

The Engineer may carry out audits and inspections during the Contract, which may include checks of the Contractor’s Quality System and records. They shall be kept up to date and be available for audit at all times during construction. If so instructed, the Contractor shall forward copies of all or part of the records to the Engineer.

Records shall be kept on site, where specified.

5.5 Completion Certificate

The Contractor shall certify that all work has been carried out in accordance with the Contract, prior to the issue of the Certificate of Practical Completion, for the whole or parts of the works as appropriate.

5.6 Construction Records

Provide construction records as specified in the relevant part of the IDS e.g. IDS clause 7.3 – Quality Assurance Requirements and Records.

The particular requirements for as-built records for each type of work are set out in IDS: Part 12 - As-Built Records and in CSS: Part 2 clause 7.8 – As-Built Records, CSS: Part 4 clause 20.0 – As-Built Records or CSS: Part 5 clause 9.0 – Completion Procedures and Certification.

Where collection of as-built information is by others, the Contractor shall facilitate the compilation of accurate records of all works constructed, particularly underground structures and services. The Contractor shall notify the Engineer if, at any time, the proposed work will inhibit the obtaining of sufficient measurements to compile these plans and shall allow the Engineer sufficient opportunity to obtain these measurements.

5.7 Measurement of Works and Basis of Payment

All costs involved in the establishment and operation of the Project Quality System, including supplying records to Council, shall be borne by the Contractor, if not scheduled separately.

All costs involved in the obtaining and providing of as-built records shall be included in the rates for the relevant item.
6.0 TEMPORARY TRAFFIC CONTROL

Temporary traffic control shall be carried out in accordance with the “Code of Practice for Temporary Traffic Management” (CoPTTM) and “Temporary Traffic Management for Local Roads Supplement” (LRS), except where amended by the following clauses.

Christchurch City Council (CCC) and the New Zealand Transport Agency (NZTA) have set up a website http://tmpforchch.co.nz/ for the submission of Traffic Management Plans (TMP) within the Christchurch Area. All Traffic Management Plans applicable to the Christchurch area must be submitted to Council and NZTA using this system.

6.1 Traffic Management Plans

All Traffic Management Plans shall be consistent with the “Code of Practice for Temporary Traffic Management”, unless a variation is approved by the Road Controlling Authority (CCC Transport and Greenspace Unit). Any application for variation shall be documented and demonstrate that the proposed TMP is safe and appropriate for the site. Any application to vary the levels of Site Traffic Management Supervisor (STMS) in the CoPTTM shall be documented.

NZTA is the Road Controlling Authority for all state highways.

The TMP Principles shall be as stated in the CoPTTM sections A2 and A6.3.

The TMP shall incorporate the required measures to cater for buses including bus lanes and bus stops, as detailed in clause 25.0 – Bus Infrastructure.

Traffic management for work sites including side roads shall be set out in compliance with the CoPTTM. Particular attention to the signage on any road intersecting with the work site road shall ensure their visibility is not compromised by vehicles parking. The signage visibility shall be monitored in compliance with the CoPTTM (2 hourly) and this monitoring should be documented.

The TMP shall incorporate the specific requirements of the Contract Documents. Nothing in the TMP shall take precedence over the requirements of the Contract Documents or the Contractor’s Health and Safety Policies. The TMP shall conform to all relevant company policies and procedures. Any exceptions shall be individually recorded in the TMP.
6.2 Amendments to the “Code of Practice for Temporary Traffic Management” by the Road Controlling Authority

Christchurch road level classifications are available at http://tmpforchch.co.nz/downloads/. Roads not detailed on this list are classed as low volume roads in accordance with the CoPTTM.

The following amendments to the Code apply for work within the Christchurch City Council area.

6.2.1 Peak Traffic Hours
No work shall be carried out on any L1 or L2 road during peak hours without approval.

Approval will depend only upon an assessment of traffic delays and will not be unreasonably withheld. An application for variation to this requirement shall be sent to the Traffic Management Co-ordinator (CCC Transport and Greenspace Unit TMC).

“Peak Traffic” hours are defined as:
- 7:00 am to 9:00 am Monday to Friday
- 4:00 pm to 6:00 pm Monday to Thursday
- 3:30 pm to 6:00 pm Friday.
Any day prior to a public holiday assumes Friday timing.

6.2.2 Plant
Plant includes Advance Warning Variable Message Signs (AWVMS), Arrow Boards, Truck Mounted Attenuators (TMA), Xenon Warning Lights, Variable Message Signs (VMS). Where any plant is used, it must comply with the CoPPTM.

Only plant that is approved for use on NZTA roads is acceptable for use on Christchurch City Council roads.

6.2.3 Variable Message Signs (VMS)
Christchurch City Council does not see VMS as a replacement for conventional pre-warning notification used for road closures, events etc. VMS should be used predominantly to draw attention to changed situations where pre-warning signage has not been used or in situations where it is necessary to communicate an immediate message to drivers.

6.2.4 Advance Warning Variable Message Signs (AWVMS)
An AWVMS replaces a tail pilot vehicle on Level 2 roads if used in accordance with the CoPTTM. An AWVMS may be also be used on LV or L1 roads where higher speeds and/or limited sight distances make its use appropriate.
The use of AWVMS is acceptable where their use could improve safety for road users and workers.

6.2.5 **Truck Mounted Attenuators (TMA)**
Where the CoPTTM has specific requirements for the use of TMA vehicles which cannot be safely or practically achieved due to site constraints, the TMC should be contacted to determine an alternative solution which meets the principles of the CoPTTM, ensures safety for road users and workers and meets the requirements of the Contractors Health and Safety Policies.

A TMA is required on multilane L2 roads with posted speed limits of 60km/hr or above.

The STMS may consider replacing the TMA with an arrowboard on constrained L1 and L2 single carriageway sites (one lane each way) that are in a low speed urban environment with a posted speed limit of 50km/hr or less,

6.2.6 **The Christchurch Tram**
Site specific Traffic Management Plans for work within legal roads that are travelled over by the Christchurch Tram shall be submitted to the Road Controlling Authority. Generic diagrams may be included in the Traffic Management Plan.

The Traffic Management Plan shall include a ‘Request to Work Near Tram Tracks’. A form template is appended to this part. This form should be signed by the Contractor and the Tramway Company before presentation with the Traffic Management Plan. The form is intended for Tramways Company use and recordkeeping.

6.2.7 **Footpath Widths**
The minimum clear footpath width in residential locations shall be 1.2m. The minimum clear footpath width in CBD locations shall be 2.0m.

6.3 **Amendments to the “Temporary Traffic Management for Local Roads Supplement” by the Road Controlling Authority**

Prior approval from the Road Controlling Authority (Christchurch City Council Transport and Greenspace) is required to work under the Local Roads Supplement.

The following amendments to the CoPTTM apply for work on Local Roads within the Christchurch City Council area, where the CoPTTM has been approved for use. The Local Road Supplement is not approved for work on state highways.
6.3.1 **Local Roads**
Local Roads, as defined in the Local Roads Supplement, shall have the same definition within Christchurch City as low volume (LV) roads, as defined in the CoPTTM.

Traffic Management Plans for rural (>70km/h) Level LV roads, where the proposed work has a duration of up to 48 hours, shall be consistent with the Local Roads Supplement.

6.3.2 **Delegated Authority to Approve**
The Road Controlling Authority may delegate authority to the STMS to approve the Traffic Management Plan on local roads only, in accordance with the criteria set out under ‘Powers and Responsibilities’ in the Local Roads Supplement.

6.3.3 **Temporary Speed Limits**
All temporary speed limit applications shall be submitted to the Road Controlling Authority. Application forms are available at [http://tmpforchch.co.nz/downloads/](http://tmpforchch.co.nz/downloads/).

6.4 **Road Closures**
A temporary road closure is required where a road will be closed to the movement of vehicular traffic. Temporary road closures shall be applied for using the Temporary Road Closure Application Form, available at [www.ccc.govt.nz/thecouncil/newsmedia/publicnotices/roadclosures.aspx](http://www.ccc.govt.nz/thecouncil/newsmedia/publicnotices/roadclosures.aspx). This form can be completed and submitted online. A TMP shall be submitted as part of the application.

Signage requirements are detailed in Temporary Road Closure - Signage Requirements, details of which are available at the web address.

An application for a road closure shall be made between 10 and 21 working days in advance, depending on the closure type and its effects. Further information is available in the Temporary Road Closure for Road Works Information Sheet, which is available at the web address.

6.5 **Events**
A Traffic Management Plan is required for any event affecting the normal operating conditions of any road and its road reserve. Temporary road closures shall be applied for using the Temporary Road Closure Application Form, as detailed in clause 6.4 - Road Closures.

An application for a road closure for an event shall be made either 60 or 84 days in advance, depending on the closure type. Further information is available in the Temporary Road Closure for Events Information Sheet, which is available at the web address.
6.6 Signs for Work on Side Roads

The following configurations are acceptable to assist with reducing the level of signage in Christchurch during the intensive work period relating to earthquake recovery and rebuild projects.

The STMS may consider the removal of signage from the main road so long as there is sufficient space to pre-warn drivers on the L1 side road prior to the taper of the worksite. Sufficient space to pre-warn drivers means:

- At 50km/h or less there is 15m minimum between the pre-warning sign and intersection and a further 15m to the taper of the worksite.
- At less than 65 km/h there is 15m minimum between the pre-warning sign and intersection and a further 25m to the taper of the worksite.
- At greater than 65 km/h as per the CoPTTM.

6.7 Positions of Signs

The following configurations are acceptable to assist with reducing the level of signage in Christchurch during the intensive work period relating to earthquake recovery and rebuild projects.

Further to the CoPTTM 4: C3.3.1 Location of temporary warning and TSL signs, on all roads temporary warning and regulatory signs are required to be located on the left-hand side of the road for the direction of travel. On L2 single carriageway roads (one lane each way), it is acceptable for the STMS to consider non-gating of Temporary Warning signage and to install signage on the left-hand side of the road only at posted speeds less than 65km/h. This clause does not apply to Temporary Speed Limit signage, which is required to be gated on all roads.

Additionally, on multi-lane raised median divided roads, and multilane one way streets with posted speeds less than 65km/h, the STMS may consider the non-gating of TW signage for activities or hazards where the effect is confined to one lane only. In such a case, e.g. temporary detours, signage can be confined to the side of the road that is affected.

6.8 Measurement of Works and Basis of Payment

Payment will be in accordance with Appendix D of the “Code of Practice for Temporary Traffic Management”. The duration of the traffic management services shall be from the date the Contractor commences construction on site to the Work Completion Date as defined below.

The Work Completion Date shall be the earliest of either:

- The Date of Practical Completion.
- The Contract Completion Date as stated in the Special Conditions of Contract, or as otherwise extended by the Engineer by approved time extensions.
• The date after which temporary traffic control is no longer required.

The Contractor must provide temporary traffic control between the Contract Completion Date and the Date of Practical Completion, at their expense, where the Date of Practical Completion is after the Contract Completion Date.

7.0 NOTICE BOARDS

The Contractor shall erect the notice board at each end of the work in a suitably lighted position, visible to pedestrians and traffic. The notice board shall not obstruct sightlines or inconvenience the public or property owners. Each notice board shall display the ‘Contractor’s Name’. Add the specified type of work after upgrading e.g. “... upgrading the water supply”.

The Christchurch City Council logo specification can be obtained by contacting the Communications Team, phone 941-8556

7.1 Pre-construction Notice Board

The notice board shall be erected two weeks prior to works commencing on site and shall be removed when the Construction Notice Board is erected.
7.2 Construction Notice Board

The notice board shall be erected immediately prior to works commencing on site.

Where work is being carried out on behalf of other parties, e.g. trenching for Utility Operators, land development, a similar sign shall be erected displaying the Principal’s name in place of the Christchurch City Council name and logo.

7.3 Measurement of Works and Basis of Payment

7.3.1 Pre-construction Notice Board
Notice boards shall include the supply, erection, maintenance over the two-week period and removal.

7.3.2 Construction Notice Board
Notice boards shall include the supply, erection, maintenance over the period of physical works and removal.

8.0 ACCEPTANCE OF SITE

Before work commences, the Contractor shall notify the Engineer of any existing defects that may impact on works. The Contractor shall take sufficient records (e.g. photographs, videotapes) of any pre-existing conditions or defects to allow a true assessment of any deterioration in their condition caused by their operations.
9.0 EXISTING SERVICES

The Contractor should obtain the latest information from the respective authorities on all services.

Any group of services of the same nature belonging to the same authority and with an overall dimension less than 600mm horizontally and vertically shall be regarded as one service for payment purposes.

10.0 NOTIFIABLE WORKS

All work in confined spaces shall be subject to the conditions set out in the Christchurch City Council “Guidelines for Entering and Working in Confined Spaces”. Prior to the commencement of work the Contractor shall present proof to the Engineer that any person entering a confined space holds a current ‘Confined Spaces Entry Permit’.

The Contractor shall not start any notifiable work until written notice has been lodged with the Occupational Safety and Health Service of the Department of Labour, as required under the Health and Safety in Employment regulations 1992.

These notifications may include work in any excavation greater than 1.5 metres deep and having a depth greater than the horizontal width.

11.0 TOILET FACILITIES

The Contractor shall provide an on-site toilet for the use of the contract or sub-contract staff for the full duration of all on-site work.

12.0 HOURS OF WORK

No work shall be undertaken on Sundays, Public Holidays, or outside the hours of 7.00 am to 6.00 pm without the Engineer’s prior consent.

Work is deemed to include any plant activity associated with the running up of operating pressures for hydraulic and lubricating systems and the cooling down of plant drive systems.

13.0 NOISE

Noise shall be limited to comply with the requirements of NZS 6803 "Acoustics - Construction Noise”.

The Contractor shall adopt the best practical option to minimise the effects of noise generation and comply with the requirements of NZS 6803 "Acoustics -
Construction Noise" by including, in the planning of the work, factors such as placing of plant, programming the sequence of operations and other management functions, noise insulation and silencers.

14.0 STOCKPILES

The size and location of stockpiles shall be in accordance with the Traffic Management Plan. The Engineer shall approve the location of all stockpiles prior to their formation.

Only in the event of all other alternatives being deemed inappropriate shall the Contractor seek the Engineer’s permission to use a reserve for a stockpile site. Note that the use of a reserve will incur costs and must be approved in writing by the Transport and Greenspace Manager.

Stockpiles shall not block existing drainage paths. The Contractor shall remove all surplus material from the site without undue delay. Areas used for stockpiles shall be restored to existing or better condition.

15.0 WORK ON OR ADJACENT TO PRIVATE PROPERTY

15.1 Agreements and Notifications

All agreements to carry out work in private property shall be in writing.

The Contractor shall give each owner and/or occupier written notice of the intended time of entering the property at least two weeks before doing so or a lesser time where agreed with the owner/occupier.

The Contractor shall keep the Engineer fully informed of any negotiations with the owners and/or occupiers, and shall supply copies of all correspondence concerning these negotiations.

15.2 Progress of Work

The Contractor shall cause as little inconvenience as possible to the owners and occupiers, and shall restrict all operations to the areas agreed by the owners and occupiers or as specified.

Once work in private property has started, this portion of the work shall proceed with as much speed as possible and no other work shall be undertaken which will hinder progress on this portion.

15.3 Planting and Existing Structures

Any fences, paths, structures or other private property disturbed, damaged or removed by the Contractor’s operations shall be restored as soon as possible to an equivalent condition and to the satisfaction of the owner.
The Contractor shall provide adequate support to any excavation when working in close proximity to the road boundary to prevent any damage or subsidence into the excavation.

15.4 Clearance

A written clearance from each owner or owner’s agent shall be obtained before the “Certificate of Practical Completion” is issued.

The Engineer may also require that the Contractor obtain a written clearance from nearby owners if their properties have been affected by the Contractor’s operations.

16.0 POTABLE WATER CONTAMINATION

Where pressurised watermains are damaged and any leakage occurs, positive pressure shall be maintained in the damaged pipe, to prevent contamination of the water supply.

Only the Council’s nominated water supply maintenance contractor may turn off the water flow in a pipe.

Where contamination is found, the Council is required to immediately isolate and remove the source of the contamination, because it could impact severely on the health of consumers, particularly the elderly, infants and people with immune deficiencies.

Where this contamination is caused by work carried out by a Contractor, this Contractor shall incur the costs of remedial work.

16.1 Standpipes

Any contractor wanting to access the Council's water supply shall apply for a water connection and hire a Council approved standpipe from Mico Pipelines, 48 Hazeldean Road, Christchurch, phone 339 5909 or 0800 101 999.

These stand pipes are fitted with a backflow prevention device and water meter. Applications for water connections shall be made by completing a WS1 form available at http://resources.ccc.govt.nz/files/WS1-waterconnection.pdf and e-mailing this through to the water connections mailbox (water.connections@ccc.govt.nz).

16.2 Measurement of Works and Basis of Payment

All costs involved in the prevention of contamination of Christchurch’s water supply shall be borne by the Contractor.
17.0 ASBESTOS

Removal and disposal of asbestos shall comply with “Guidelines for the Management and Removal of Asbestos”. Contact the Council’s landfill operator for requirements regarding the handling and disposal of asbestos.

18.0 EROSION, SEDIMENT AND DUST CONTROL

18.1 Dust Nuisance

The Contractor shall take all reasonable precautions to mitigate the dust nuisance to adjacent properties and the public.

Where the Contractor stockpiles material on or off the site, any measures required to prevent a dust or litter nuisance shall be taken at the Contractor’s cost.

Should the Contractor fail to take immediate action to satisfactorily control dust or litter when instructed to do so by the Engineer, or if the Contractor can not be contacted, the Engineer may have the necessary work carried out and recover all costs incurred from the Contractor.

18.2 Stormwater and Land Drainage

Contractors shall design and implement an Erosion and Sediment Control Plan (ESCP), in accordance with IDS clause 4.8 – Erosion, Sediment and Dust Control, to control the discharge of contaminants during construction. The Contractor shall submit the ESCP to Council one week before construction starts.

The Council will audit the Erosion and Sediment Control Plan for compliance over the period of the works.

Possible sources of contaminants from construction activities additional to those in IDS clause 4.8 – Erosion, Sediment and Dust Control, include sawcutting, grooving, waterblasting, dewatering and uncontrolled runoff. Possible contaminants include slurries from cutting pavers, dust from stockpiles, bituminous materials and fine silts removed by dewatering activities.

18.3 Measurement of Works and Basis of Payment

All work to control erosion, sediment and dust and to prevent contamination shall be included in the rates for the relevant items being constructed.
19.0 PROTECTION OF NATURAL ASSETS AND HABITATS

Natural assets and habitats include landscape features such as waterways, wetlands and their wildlife, planting including trees, shrubs, grass areas and groundcover and structures.

19.1 Existing Features

Before the commencement of the work, the Contractor shall clearly identify and protect all site features (e.g. specimen trees, shrubs, plant beds and structures) that are to be preserved or reinstated.

19.2 Waterways and Their Wildlife

Any natural waterways shall be outside of the Contractor’s work site unless the contract specifically states otherwise.

19.3 Tree and Vegetation Protection

Protected trees and vegetation include notable trees and heritage trees, as listed in the City Plan, trees in special purpose zones including Special Purpose Road Zones (street trees); trees and vegetation protected in other zones; Ecological Heritage Sites, as identified in the City Plan; or trees on the list of trees protected by subdivision approval and by resource consent. This latter list is available through the Council’s Arborist team.

Private trees include trees located within private property that may be affected by road upgrades, significant trees or vegetation on land identified for intensification in both Greenfield and Brownfield areas.

Work around and on protected trees and vegetation may require a resource consent for the works.

19.4 Protection of Existing Trees (including Private Trees)

Where works on protected trees and vegetation are covered under the Global Consent for Works Affecting Protected Vegetation, the relevant conditions of the resource consent shall take preference over the following requirements.

A temporary barrier shall be erected around all existing trees that are identified to be retained on site. This barrier shall create a physical barrier with a minimum height of 1.8 metres, for example hurricane fencing, erected at the extremity of the tree’s drip line as defined in SD 110.

Where the work site is only on one side of the tree the barrier shall be erected along the face of the tree adjacent to the work site in each direction away from the tree and at the drip line as defined in SD 110.
This barrier shall be erected before any works around or adjacent to the trees commence and shall not be removed or moved until that section of work is complete, without the prior approval of the Council’s Arborist.

No chemicals, fill, equipment or machinery shall be stored behind the barrier or within the drip line except on existing hard surfaces. No machinery shall be parked within or driven through the fenced area. Water used for washing down machinery shall not run off under the dripline unless on an existing sealed surface.

There must not be any direct contact between wash down water, chemicals, fill, equipment or machinery and the root plate.

Where it is not possible to complete the works without encroaching within the tree’s drip line, a proposed methodology shall be submitted to the Engineer for approval prior to work commencing. Where there are excavations (including thrusting pits) within the drip line the Contractor shall appoint a qualified arborist. The name and qualifications of the arborist shall be submitted to the Council’s Arborist for approval. This arborist shall be present on site at all times whilst these works are being undertaken.

19.4.1 Tree Roots and Root Plates

All roots larger than 25mm diameter shall be retained in an undamaged state and protected, unless the Council’s Arborist gives permission in advance for them to be cut. No ripping or tearing of roots (including the root plate itself) shall occur.

Roots which have a significant affect on the health and stability of the tree shall not be cut without the Council Arborist’s approval. Where consent is given to cut roots they shall be severed cleanly with a saw or pruning shears by a qualified arborist. The name and qualifications of the arborist shall be submitted to the Council through the Contract Quality Plan.

All exposed roots and cut root ends shall be protected from drying and frost with damp sacking/scrim, polythene or similar material if not backfilled immediately.

Where the Engineer has not approved the use of excavated material for backfilling, backfill shall consist of 70% first grade top soil and 30% coir (or a similar product approved by the Engineer). The backfill shall be mixed thoroughly.

Unless prior approval from the Council’s Arborist has been obtained, all underground services within the tree’s drip line as defined in SD 110 shall be installed by trenchless methods. Otherwise, excavations within the distances set out in the table below shall be carried out by hand. Care shall be exercised while excavations are carried out so root damage is minimised.
<table>
<thead>
<tr>
<th>Trunk diameter at ground level</th>
<th>Minimum distance from edge of trunk</th>
<th>Tree class</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 100mm</td>
<td>1 metre</td>
<td>All</td>
</tr>
<tr>
<td>101 - 300mm</td>
<td>2 metre</td>
<td>All</td>
</tr>
<tr>
<td>301 - 500mm</td>
<td>4 metre</td>
<td>All</td>
</tr>
<tr>
<td>501 - 1000mm</td>
<td>5 metre</td>
<td>Protected trees</td>
</tr>
<tr>
<td>501mm and above</td>
<td>5 metre</td>
<td>Other trees</td>
</tr>
<tr>
<td>1001mm and above</td>
<td>10 metre</td>
<td>Protected trees</td>
</tr>
</tbody>
</table>

Other trees are those not defined as protected trees in clause 19.3 – Tree and Vegetation Protection.

19.5 Damage to Existing Features

The Contractor shall compensate the Council for any damage done to existing features, either by means of a monetary sum or by replacement of that feature. The Engineer will determine any compensation for damaged landscape planting, in consultation with the Council.

19.6 Tree Removal

No trees shall be removed unless they have been specifically identified and marked during a joint inspection by the Engineer and the Contractor. Trees shown on the drawings as conflicting with the works, but without an explanation of whether or not they are to be removed, must not be removed until they are identified as above. The Contractor shall notify the Engineer of trees which are not shown on the drawings, but which appear to be in conflict with the works.

19.7 Measurement of Works and Basis of Payment

All work around existing features shall be included in the rates for the relevant items being constructed.

20.0 ARCHAEOLOGICAL DISCOVERY

An archaeological authority is required if there is “reasonable cause” to suspect that an activity may affect any archaeological material. An authority is required regardless of the legal status of the land on which the site is located, whether the activity is permitted under the District or Regional Plan or whether a resource or building consent has been granted.

If previously unknown archaeological material is uncovered during earthworks:
- all work within 100m of the site shall cease immediately,
- the site shall be secured to prevent disturbance of the remains and make the site safe,
- the Contractor shall notify the Engineer, who shall contact the Historic Places Trust.
21.0 NOTIFICATION OF AUDIT INSPECTIONS

The Contractor shall give a minimum of two working days notice to the Engineer when works are ready for audit inspections. Audit inspections include standards and material compliance inspections of all aspects of work.

22.0 ACCESS AND TEMPORARY BRIDGING

Access to properties shall be maintained at all times when the Contractor is off-site. Access to commercial properties shall be maintained at all times during business hours (unless by mutual agreement with the owner or occupier). Access to all other properties shall be maintained at all times unless by mutual agreement with the owner or occupier.

The Contractor shall contact each property owner or occupier at least three days prior to commencing work near their property and inform them of the length of time that property will be affected by the work. The Contractor shall keep diary notes and records of contact and discussions with property owners and occupiers.

22.1 Temporary Bridging

Should steel plates be used as temporary bridging they shall be:

- 12mm thick with chamfered edges.
- secured to the carriageway without a gap between the plate and the road surface.
- placed to prevent noise from vehicles when being crossed.
- used to span a maximum distance of 1.0m.
- wide enough to ensure that the sides of the trench remain stable.

Steel plates shall not be used as temporary bridging within the carriageway for more than 24 hours. The Engineer shall approve their use before installation.

22.2 Measurement of Works and Basis of Payment

The provision of adequate temporary crossings and bridging shall be included in the rates for the relevant item being constructed.

23.0 METER SHROUDS

The Contractor shall obtain the necessary parking meter shrouds where metered spaces are being used during the course of the works. The cost of obtaining meter shrouds shall be borne by the Contractor.
24.0 TAXI STANDS

Where work on roads obstructs adjacent taxi stands, the Contractor shall make arrangements for alternative taxi stands, including the covering of signs that are temporarily not in use.

The Contractor shall notify the Taxi Federation where temporary stands are not immediately adjacent to the relocated stand.

24.1 Measurement of Works and Basis of Payment

The provision of taxi stands shall be included in the rate for the item affecting them.

25.0 BUS INFRASTRUCTURE

Buses should not be delayed and where possible priority shall be given to their movements.

All in-use bus stops shall be accessible to all intending passengers, including those with disabilities. Access should be via a smooth, unobstructed path a minimum of 1200mm wide and of materials suitable for the smooth operation of a wheelchair.

25.1 Temporary Bus Stops

Where work on roads obstructs adjacent bus stops the Contractor shall provide temporary bus stops for the full period of the works. The temporary stops shall comply with SD 102 and be located as near as possible to the current stop. The Site Traffic Management Supervisor shall confirm that the bus stop is provided as part of the Traffic Management Plan (TMP).

The bus stop area, including lead-in and out, shall be kept free of obstructions at all times.

Both bus doors shall be clear of cutdowns. Temporary stops should be adjacent to a full height kerb where possible. Where proposed stops are over vehicle crossings, residents shall be advised in writing before placement and any concerns raised by them taken into account. The camber of the verge should be considered to ensure that the step up into the bus is not excessive nor that the bus is leaning on an excessive angle.

Notification of temporary bus stop locations and their intended duration shall be made to ECanBusControl@ecan.govt.nz a minimum of two working days prior to their relocation.
25.1.1 **Pedestrian Requirements**
Temporary bus stops shall have a waiting area adjacent to the bus boarding area. Both areas shall be clean, level, dry and of sufficient size to accommodate all intending passengers. If a suitable area is not currently available, the Contractor shall construct one.

25.1.2 **Signage**
A Temporary Bus Stop sign should be placed 5.0m inside the clear area of the bus stop directly adjacent to the passenger’s boarding area. Signs shall be on full height poles and not obscured by other signs or obstructions. In high parking demand areas, discuss additional signage requirements with Council.

Permanent bus stop signs shall be covered and signage attached directing passengers to the temporary bus stop. Where no temporary bus stop is available a map showing alternate bus stop locations shall be displayed. Notification signage shall be in place on permanent bus stops two working days prior to the stop being unavailable for use.

25.2 **Bus Route Detours**

Traffic detours or road closures on a bus route should be avoided at all times and should only be applied when there is no alternative site work practice available. Any road or lane closures shall allow buses particularly to return to their normal route as soon as possible once past the closure.

Any detour for buses should follow the same route in both directions to avoid confusion for passengers. Detours shall be along suitable roads allowing free bus movement and the placement of temporary bus stops.

Notification of any detours shall be made to ECanBusControl@ecan.govt.nz (as per the TMP Form) a minimum of five working days prior to the commencement of the detour.

25.3 **Bus Lanes**

There shall be no impediment to the operation of bus lanes during their operational hours. “No impediment” includes that but is not limited to:
- no cones shall be placed in the bus lane, even for works associated with a side street,
- no equipment shall be left in the bus lane at any time.
- works should be undertaken outside operational hours, where possible,
- uncompleted works should be backfilled and compacted at grade to provide a seamless surface or be covered with a clearly visible non-skid steel plate.

All work shall be sealed and repainted within 24 hours.
Operational hours for bus lanes are generally between 7am – 9am along inbound routes, and 2.30pm – 6pm along outbound routes, Monday to Friday. The operational hours for a particular area should be checked according to the signage posted along the bus lane.

Where emergency works are required in a bus lane the Bus Exchange Control Room shall be advised immediately (using their emergency only number 353 9703) of the details of the work being done, the expected duration and what procedures are in place to accommodate bus priority.

Where the bus lane becomes unavailable during operating hours due to the works, alternative Traffic Management measures shall be required to allow buses priority to manoeuvre around works without delay at all times.

25.4 Measurement of Works and Basis of Payment

The provision of temporary bus stops and bus route detours shall be included in the rate for the item affecting the bus infrastructure.

26.0 SURFACE BOXES

26.1 Access to Fire Hydrants and Sluice Valves

Fire hydrants shall remain visible and accessible at all times.

If a sluice valve is covered, its location shall be marked with offset pegs.

The Contractor shall provide immediate access to any covered valves on request.

26.2 Adjustment of Fire Hydrant, Sluice Valve and Combination Boxes

Fire hydrant, sluice valve and combination surface boxes shall be adjusted in accordance with CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works.

26.3 Roadmarking of Fire Hydrants and Sluice Valves

Roadmarking of fire hydrants and sluice valves shall be carried out in accordance with the requirements of CSS: Part 4 clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves.

26.4 Adjustment of Manholes

Manholes shall be adjusted in accordance with CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.
26.5 Adjustment of Other Network Assets

All network assets not owned by the Christchurch City Council shall be adjusted in accordance with that utility operator’s requirements.

26.6 Measurement of Works and Basis of Payment

All work to provide access to fire hydrants and sluice valves shall be included in the rates for the relevant item being constructed.

27.0 TRAFFIC SIGNAL LOOPS

All signalised intersections have wire detector loops sawcut into the road surface. These loops are either approximately 1.5m or 30m behind the limit lines. They are vital to the operation of the traffic signals at the intersection and, in many cases, the surrounding signalised intersections. The loops must be kept in operation as long as possible, by cutting them at the last instance and restoring them as soon as practicable. To facilitate this, the following procedure shall be followed.

27.1 Permission

Permission to cut any loop shall be gained from the Transport and Greenspace Traffic Systems Team, phone 941-8620, 72 hours prior to the proposed cutting.

Permission is not automatic and may be withheld, for instance until after special events or until other work is completed. Generally, only one intersection per street shall be cut at any one time. However, where extenuating circumstances can be proven, this restriction may be lifted after consultation with the Transport and Greenspace Traffic Systems Team.

27.2 Loop Reinstatement Fee

The Contractor will not pay the fee, unless otherwise specified. Where it is specified that the Contractor pay the fee, it shall be paid to Christchurch City Council before permission will be given to cut any loops. It is also payable where the loop has been reinstated again as set out in the “Timing” clause below.

Fees to reinstate loops will be individually determined. Typically the fee to have one loop reinstated in a Level 1 road is $500.

Where permission has not been obtained prior to cutting the loop, a penalty of $250 will be added to this fee.
27.3 Notification

Once permission is obtained, the Contractor shall give one working day’s notice that a traffic loop will be cut. The Contractor shall inform the Transport and Greenspace Traffic Systems Team, phone 941-8622, of any change in the cutting date.

27.4 Replacement

27.4.1 Timing
The Contractor shall give notice that the loop is ready to be replaced no more than three days after it has been cut.

If notification is not received within this time, Council shall issue a 24-hour notice of its immediate intention to reinstate the loop. The Contractor may be liable for the cost of a further loop reinstatement if the completion of the works necessitates cutting the loop again.

27.4.2 Extensions to Reinstatement Timing
If the Contractor considers that the time allowed above is inadequate for reinstatement and notification, they should contact the Transport and Greenspace Traffic Systems Team, who may extend these periods where extenuating circumstances can be proven.

Where the works to allow loop reinstatement cannot be completed within an acceptable time frame, e.g. works including porous asphalt, the loop may need to be installed into a temporary surface and then reinstated when the final surfacing is applied. In this circumstance, the loop fee will be paid twice. Milling, stripping or resurfacing in conjunction with this reinstatement, as set out in the following clause, may also be required.

27.4.3 Damage to Road Surface through Multiple Loop Cutting
Where the works will result in three separate loop cuts in the final road surface, the area of the loops shall be resurfaced. These cuts may exist prior to the work or be new cuts necessary due to the Contractor’s works.

The Contractor shall mill or strip and resurface the area to the same standards as the final surfacing of their excavation. This resurfacing shall be completed prior to loop reinstatement.

27.5 Measurement of Works and Basis of Payment

Traffic loop reinstatement, where specified, shall include the fees as set out above, any temporary installations required, milling, stripping and resurfacing where necessary as stated above.
Where traffic loop reinstatement is not specified separately, the Contractor shall allow for any milling, stripping and resurfacing as stated above in the rates for the relevant items being constructed.

Where the traffic loop reinstatement is due to damage or lack of notification on behalf of the Contractor, all fees, any temporary installations required, milling, stripping and resurfacing where necessary as stated above shall be at the Contractor’s cost.

28.0 EXCAVATION

Excavation carried out to permit the installation of network services in legal roads shall be carried out in accordance with the particular requirements regarding materials and their depths of the Works Access Permit for that work. Apply for a Corridor Access Request (CAR) at www.beforeudig.co.nz to obtain the Works Approval Notice.

All works shall also comply with the National Code for Utility Operators’ Access to Transport Corridors and the CCC Local and Special Conditions, except where superseded by the CSS series or the contract documents.

Where pipes or other services or structures in the vicinity of the works may be structurally endangered by subsoil dewatering, the Contractor shall stop pumping and make suitable arrangements to prevent the removal of these sediments.

The Contractor shall notify the Engineer when the base of the excavation may be unsuitable. The Engineer may order extra excavation to remove this material.

Specific requirements regarding the excavation for network services are detailed in that Part e.g. CSS: Part 4 clause 9.0 - Excavation.

29.0 BACKFILLING

Backfill includes filling to trenches and other excavations and excludes haunching, bedding and metalcourses or topsoil. Backfill material shall be as specified. The Engineer may approve the use of excavated material for backfill.

29.1 Backfilling Within Legal Road

The backfilling and maintenance of excavations for the installation of network services in legal roads must be carried out in accordance with the particular requirements regarding materials and their depths of the Works Access Permit for that work. All works shall also comply with the National Code for Utility Operators’ Access to Transport Corridors and the CCC Local and Special Conditions, except where superseded by the CSS series or the contract documents.
Excavations in permanent surfaces shall be sealed within five days of backfilling.

29.2 Trafficked Areas

*CCC pitrun and CCC AP65 shall be compacted to a minimum dry density of 2,150kg/m³.*

The dry density shall be determined in accordance with NZS 4402.4.1.1 “New Zealand standard compaction test” for stabilised materials or NZS 4402.4.1.3 “New Zealand Vibrating Hammer Compaction Test” for granular materials, unless otherwise specified.

29.3 Pedestrian Areas

*CCC pitrun and CCC AP65 shall be compacted to a minimum dry density of 2,150kg/m³.*

The dry density shall be determined in accordance with NZS 4402.4.1.1 “New Zealand standard compaction test” for stabilised materials or NZS 4402.4.1.3 “New Zealand Vibrating Hammer Compaction Test” for granular materials, unless otherwise specified.

29.4 Landscape Areas

*Backfill material shall be compacted to 70% of that material’s maximum dry density (MDD).*

The dry density shall be determined in accordance with NZS 4402.4.1.1 “New Zealand standard compaction test” for stabilised materials or NZS 4402.4.1.3 “New Zealand Vibrating Hammer Compaction Test” for granular materials, unless otherwise specified.

29.5 Quality Assurance

The Contractor shall ensure that sufficient records are kept to show that the backfill complies with the above requirements. The Transport and Greenspace Unit may request records of compaction tests on work carried out under a Works Access Permit.

29.5.1 Compaction Tests

Compaction tests, by Nuclear Densometer, Clegg hammer or other approved impact device, shall be carried out on each compacted layer. Nuclear density testing shall be carried out by an operator holding Unit Standard 25832 Use a nuclear density meter to measure compaction of soils, sands and gravels. All compaction testing appliances shall hold current calibration certificates.
As a guide, a minimum Clegg Impact Value of 35 in the carriageway, right of way or commercial crossing or 25 in other areas shall be achieved at any point on any layer.

30.0 RESTORATION AND FINAL SURFACING

Restoration and final surfacing shall be carried out in accordance with the requirements in CSS: Part 6 - Roads or CSS: Part 2 - Earthworks and CSS: Part 7 - Landscapes for that type of work.

30.1 Restoration and Final Surfacing in Legal Roads

Restoration, final surfacing and excavation maintenance in legal roads shall be carried out in accordance with the particular requirements regarding materials and their depths of the Works Access Permit for that work.

Where the work is included within contract works, it shall be carried out in accordance with the particular requirements, regarding materials and their depths, of the specified restoration type, as detailed in SD 101.

Work shall also comply with the National Code for Utility Operators’ Access to Transport Corridors and the CCC Local and Special Conditions, except where superseded by the CSS series or the contract documents.

30.2 Lengths of Open Trench

Trenches are considered ‘open’ until within 10mm of the finished surface.

Trench restoration or final surfacing shall be continually carried out to ensure the maximum lengths of open trenching, as specified in the particular parts, are not exceeded. These lengths may be reduced at intersections and where crossing carriageways.

31.0 CCC AGGREGATE GRADINGS AND SPECIFIC REQUIREMENTS

Metalcourses may contain up to 5% of recycled glass, providing the material complies with all other specified requirements. Council will be incorporating a tender attribute reflecting the incorporation of sustainably produced materials.

All testing shall be carried out in accordance with the relevant test procedure in NZS 4407 “Methods of sampling and testing road aggregates”. Testing shall be carried out in an approved laboratory.
31.1 CCC Pitrun

Pitrun does not have a specified grading however it shall meet the following criteria:
- Pitrun shall not be gap graded.
- Pitrun shall be free of organic matter.
- The fraction passing the 75-micron sieve shall be substantially non-plastic.
- Pitrun shall not contain stone larger than 150mm.
River-run material from Waimakariri River sources downstream of the railway bridge adjacent to Main North Road, or any material excavated from below water level, is not acceptable as sub-base material.

31.2 CCC AP65

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>65.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>60 - 90</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>45 - 65</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>30 - 50</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>20 - 40</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>10 - 28</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>7 - 22</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>5 - 16</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>4 - 12</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>3 - 8</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>3 - 6</td>
</tr>
</tbody>
</table>

- CCC AP65 shall be free of organic matter.
- Less than 10% fines shall pass a 2.36mm sieve after a crushing resistance test with a 130kN load.
- CCC AP65 shall either have a sand equivalent greater than 25 or the fraction of the aggregate passing a 0.075mm sieve shall have a clay index less than 3 or the fraction of the aggregate passing a 0.425mm sieve shall have a plasticity index less than 5.

31.3 CCC GC 65-40

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>63.0 mm</td>
<td>80 – 100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

- 50% of the aggregate by weight shall have 2 or more broken faces.
- Aggregate shall be free of deleterious material.

31.4 CCC RCC M/4:AP40

Recycled crushed concrete (RCC) M/4:AP40 shall comply with the TNZ M/4 Specification.
### 31.5 CCC Drainage AP40

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>50 - 100</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>25 - 50</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>0 - 15</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>0 - 8</td>
</tr>
</tbody>
</table>

- 50% of the aggregate by weight shall have 2 or more broken faces.
- Aggregate shall be free of deleterious material.
- Fines (percentage passing 0.425mm sieve) shall be non-plastic.

### 31.6 CCC Stabilised AP40

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>80 - 95</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>50 - 75</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>30 - 50</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>20 - 38</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>17 - 33</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>14 - 28</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>10 - 23</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>8 - 20</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>5 - 12</td>
</tr>
</tbody>
</table>

- 50% of the aggregate by weight of total quantity retained on a 4.75mm sieve shall have 2 or more broken faces.
- Aggregate shall be free of deleterious material.
- Fines (percentage passing 0.425mm sieve) shall have a plasticity index less than 5.

The percentage of material within the given fractions shall be as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0 - 4.75 mm</td>
<td>17 - 56%</td>
</tr>
<tr>
<td>9.5 - 2.36 mm</td>
<td>12 - 27%</td>
</tr>
<tr>
<td>2.36 - 0.600 mm</td>
<td>10 - 20%</td>
</tr>
</tbody>
</table>
31.7 CCC Stabilised AP20

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>55 - 80</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>35 - 60</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>25 - 45</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>22 - 40</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>18 - 35</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>15 - 30</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>12 - 23</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>8 - 15</td>
</tr>
</tbody>
</table>

- 50% of the aggregate by weight of total quantity retained on a 4.75mm sieve shall have 2 or more broken faces.
- Aggregate shall be free of deleterious material.
- Fines (percentage passing 0.425mm sieve) shall have a plasticity index less than 5.

The percentage of material within the given fractions shall be as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5 - 2.36 mm</td>
<td>20 - 45%</td>
</tr>
<tr>
<td>2.36 - 0.600 mm</td>
<td>5 - 25%</td>
</tr>
</tbody>
</table>

31.8 CCC GC 22-16

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>22.4 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>16.0 mm</td>
<td>0 - 5</td>
</tr>
<tr>
<td>13.2 mm</td>
<td>0</td>
</tr>
</tbody>
</table>

- 50% of the aggregate by weight of total quantity retained on a 4.75mm sieve shall have 2 or more broken faces.
- Aggregate shall be free of deleterious material.
- AGD : ALD shall be less than 2.25.

31.9 CCC GC 14-10

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>16.0 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

- 90% of the aggregate by weight shall have 2 or more broken faces.
### 31.10 Swale (2A) Sand

<table>
<thead>
<tr>
<th>Sorting ($d_{60}/d_{10}$)</th>
<th>Mean grain size ($d_{50}$) mm Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>0.13</td>
<td>0.59</td>
</tr>
<tr>
<td>2.0</td>
<td>0.15</td>
<td>0.75</td>
</tr>
<tr>
<td>3.0</td>
<td>0.20</td>
<td>1.15</td>
</tr>
<tr>
<td>5.0</td>
<td>0.58</td>
<td>2.40</td>
</tr>
<tr>
<td>17.0</td>
<td>5.40</td>
<td>5.40</td>
</tr>
</tbody>
</table>

- The sand shall be free of organic matter.
- $d_x$ is the sieve size that $x\%$ of the sample, by weight, shall pass.

The two columns in the above table set out the axes for plotting the material envelope.

To determine the above sorting and mean grain size values of any material, first plot its sieve analysis. Then, to determine the $d_{10}$ value for example, read from the plotted sieve analysis the particle size (mm) equating to the 10% passing point on the curve.

### 31.11 Backfilling Sand

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>0 - 12</td>
</tr>
</tbody>
</table>

- The sand shall be free of organic matter.
- Fines (percentage passing 0.075mm sieve) shall be non-plastic.

### 31.12 Stiff Flowable Mix

<table>
<thead>
<tr>
<th>Material</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCC Stabilised AP20</td>
<td>1 m$^3$ (loose)</td>
</tr>
<tr>
<td>Hydrated Lime</td>
<td>60kg</td>
</tr>
<tr>
<td>Cement</td>
<td>120kg</td>
</tr>
<tr>
<td>Water (total)</td>
<td>120 litres</td>
</tr>
</tbody>
</table>

- Site mixed material requires the Engineer’s prior approval.

### 31.13 Firm Mix

<table>
<thead>
<tr>
<th>Material</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCC Stabilised AP20</td>
<td>1 m$^3$ (loose)</td>
</tr>
<tr>
<td>Hydrated Lime</td>
<td>60kg</td>
</tr>
</tbody>
</table>

- Site mixed material requires the Engineer’s prior approval.
31.14 Lime Stabilised Backfill

<table>
<thead>
<tr>
<th>Material</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCC Stabilised AP40</td>
<td>1 m³ (loose)</td>
</tr>
<tr>
<td>Hydrated Lime</td>
<td>40kg</td>
</tr>
</tbody>
</table>

- Site mixed material requires the Engineer’s prior approval.

31.15 Filter Medium

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.5 mm</td>
<td>100</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>90 - 100</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>55 - 80</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>40 - 60</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>36 - 52</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>26 - 42</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>18 - 30</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>8 - 18</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

- 50% of the aggregate by weight of total quantity retained on a 4.75mm sieve shall have 2 or more broken faces.
- Aggregate shall be free of deleterious material.
- Fines (percentage passing 0.425mm sieve) shall have a plasticity index less than 5.

32.0 CCC ASPHALTIC CONCRETE GRADING

All asphaltic concrete shall be manufactured to the requirements of the current Transit New Zealand M/10 Specification and supplied by an asphalt plant certified to AS/NZS ISO 9001: 2000 “Quality management systems – Requirements”.

32.1 CCC AC5

AC5 shall be manufactured to the gradings below.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.7 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>90 – 100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>60 – 80</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>40 – 60</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>27 - 43</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>18 – 32</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>12 – 22</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>6 - 12</td>
</tr>
</tbody>
</table>
• Bitumen shall be 80/100 penetration grade complying with the requirements of TNZ M/1.
• Air voids shall be between 2.5 and 3.5%.
• Sufficient bitumen shall be incorporated in the mix so that a minimum stability of 6.6kN is achieved. (Bitumen content will be generally about 7.0%).

### 32.2 CCC AC7

AC7 shall be manufactured to the gradings below.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.7 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>75 - 90</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>60 - 75</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>40 - 60</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>30 - 47</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>20 - 35</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>12 - 22</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>6 - 12</td>
</tr>
</tbody>
</table>

• Bitumen shall be 80/100 penetration grade complying with the requirements of TNZ M/1.
• Sufficient bitumen shall be incorporated in the mix so that a minimum stability of 6.6kN is achieved. (Bitumen content will be generally about 7.0%).
• Air voids shall be between 3.0 and 3.5%.

### 32.3 CCC AC16

AC16 shall be manufactured to the gradings below.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>9.5 mm</td>
<td>70 - 90</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>52 - 70</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>40 - 55</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>29 - 43</td>
</tr>
<tr>
<td>0.600 mm</td>
<td>20 - 32</td>
</tr>
<tr>
<td>0.300 mm</td>
<td>13 - 23</td>
</tr>
<tr>
<td>0.150 mm</td>
<td>8 - 16</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>4 - 10</td>
</tr>
</tbody>
</table>
33.0 CCC LAWN SEED MIXTURES

- All turf ryegrasses shall have a certified endophyte content of no less than 80%, unless otherwise specified.
- The Engineer shall approve all cultivars prior to sowing.
- Proportions shall be by weight.

33.1 Amenity Area Mix

Amenity area mix shall contain:

- 70% Sports (dwarf) rye grass (a mixture of up to 3 cultivars may be used)
- 25% Chewings type red fescue
- 5% Brown top

33.2 Berm Mix

Berm mix shall contain:

- 68% Sports (dwarf) rye grass (a mixture of up to 3 cultivars may be used)
- 20% Chewings type red fescue
- 10% Creeping type red fescue
- 2% Brown top

33.3 Pasture Mix

Pasture mix shall contain:

- 70% Pasture rye grass with no endophyte
- 10% Cocksfoot
- 10% White clover
- 10% Red clover

33.4 Playing Field Mix

Playing field mix shall contain:

- 100% Sports turf rye grass with 80% endophyte

33.5 Low Fertility/Drought Mix

Low fertility/drought mix shall contain:

- 60% Sports (dwarf) rye grass (a mixture of up to 3 cultivars may be used)
- 20% Chewings type red fescue
- 10% Creeping type red fescue
- 5% Kentucky bluegrass
- 5% Brown top
34.0 TOPSOIL

34.1 Imported First Class Topsoil

Topsoil shall be sourced from an original ground surface layer that has been subject to minimal prior disturbance.

Topsoil shall exhibit the presence of biological activity as evidenced by adequate aggregation and organic matter content. The material shall be acceptable for growing all of the appropriate species, given adequate management, and shall not contain any substances injurious to plant growth.

Soil arising from re-claimed land, industrial sites, or land that has been used for the disposal of any industrial, domestic or agricultural wastes shall not be used.

34.1.1 Topsoil Characteristics

Topsoil shall contain less than 5% by dry weight of solid detritus and debris (brick, concrete, glass, metal, plastic, wood, rubber, tree roots). The stone content shall be less than 10% by dry weight. The topsoil shall not contain any object larger in dimension than 30 mm.

Soil shall be well aerated, as evidenced by an absence of mottling and grey/blue colours. There shall be no traces of a sewage-like smell.

The clay content shall not exceed 25% by dry weight. The soil shall have an organic matter content between 7% and 20% by dry weight. Topsoil containing recognisable remains of fresh plant or organic material is unacceptable.

Organic matter is defined as the remnants of fully decomposed material of biological (primarily plant) origin. Undecomposed or partly decomposed plant material visible to the naked eye is not classified as organic matter.

34.1.2 Topsoil Structure

Topsoil shall be loose and friable, breaking down by hand to aggregates of 1-10 mm in diameter.

Samples of such soils shall exhibit a stability ratio of more than 50% and a mean weight diameter of more than 0.75 mm under standard wet sieving conditions (as determined by NZSTI structural stability assessment test).

Soil with coarse aggregates, mainly 30-70 mm in diameter, or large clods, (greater than 50mm in diameter) with roots present
only in cracks between clods and needing considerable force to break them apart, is unacceptable.

34.1.3 Soil Handling and Storage

Topsoil that has been handled in any way when its moisture content is above field capacity is unacceptable. Topsoil that has had its structure modified by milling, crushing or any comparable processing, is unacceptable. Topsoil that has been rotary hoed more than twice since it was ‘mined’ is unacceptable.

Sieving, with the exception of through any mesh finer than 30mm, is acceptable only where screened topsoil is specified.

Topsoil may be stored in the open for up to 3 months provided stockpiles are less than 3m in height. Topsoil may be stored for longer periods if under cover and air-dry and with a stockpile height of less than 3m.

34.1.4 Nutrient Content and Soil pH

Topsoil shall have a soil pH of between 5.5 and 7.5.

Nutrient amendment may be required.

34.1.5 Testing

The Engineer may require test results to confirm the topsoil complies with this specification. Testing shall be carried out in an approved laboratory.

The basic soil nutrient test shall include pH, phosphorus, extractable cations, cation exchange capacity and total base saturation.

34.2 Imported Second Class Topsoil

Second class topsoil shall not contain any substances injurious to plant growth.

Soil arising from re-claimed land, industrial sites, or land that has been used for the disposal of any industrial, domestic or agricultural wastes shall not be used.

The Engineer may approve excavated material for use as second class topsoil.

34.2.1 Second Class Topsoil Characteristics

Second class topsoil shall contain less than 15% by dry weight of stones, solid detritus and debris (brick, concrete, glass, metal, plastic, wood, rubber, tree roots). Second class topsoil shall not contain any object larger in dimension than 30 mm.
The clay content shall not exceed 20% by dry weight. The soil shall have an organic matter content over 2.5% by dry weight. Second class topsoil containing recognisable remains of fresh plant or organic material is unacceptable.

Organic matter is defined as the remnants of fully decomposed material of biological (primarily plant) origin. Undecomposed or partly decomposed plant material visible to the naked eye is not classified as organic matter.

34.2.2 **Soil pH**
Second class topsoil shall have a soil pH of between 5.5 and 7.5.

34.2.3 **Testing**
The Engineer may require test results to confirm the second class topsoil complies with this specification. Testing shall be carried out in an approved laboratory.

34.3 **Measurement of Works and Basis of Payment**
Testing of topsoil shall be included in the rate for supply.

### 35.0 MULCH

#### 35.1 Recycled Mulch

*All mulch shall be pasteurised composted mulch complying with the requirements of NZS 4454 “Composts, soil conditioners and mulches”.*

Recycled mulch shall consist of the following grades:
- Normal grade as defined by NZS 4454 “Composts, soil conditioners and mulches” (with more than 20% of particles under 20mm diameter).
- Medium grade, with a minimum of 70% of particles between 40mm and 75 mm diameter.
- Over 80mm grade, with no less than 70% of particles 75mm diameter or greater.

#### 35.2 ‘Bark’ Mulch

*‘Bark’ mulch is primarily derived from bark. Bark mulch shall not have more than 25% wood chips. The inorganic component of bark mulch shall not exceed 1.0%.*

Generally, ‘bark’ mulch shall consist of three grades:
- Fine grade, where 60% of particles are under 10mm diameter and 40% are between 11-40mm diameter.
- Medium grade, where all particles are between 11-40mm diameter.
• Coarse grade, where 25% of particles are between 11-40mm diameter and 75% are between 41-350mm diameter.

Premium grades shall have less than 2% wood chip and shall be subject to approval by the Engineer.

36.0 SOIL CONDITIONERS OR COMPOST

36.1 Soil Conditioner

All soil conditioners shall be pasteurised composted soil conditioners complying with the requirements of NZS 4454 “Composts, soil conditioners and mulches”.

36.2 Compost

All composts shall be pasteurised composted composts complying with the requirements of NZS 4454 “Composts, soil conditioners and mulches”.

37.0 STRUCTURAL SOIL

Structural soil shall consist of 2.7 parts structural aggregate to one part moist soil mix, mixed to provide a homogeneous material. Slow release fertiliser, to the manufacturer’s recommendations, shall be incorporated. The Engineer shall inspect all site mixed material prior to placement.

37.1 Structural Aggregate

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.0 mm</td>
<td>100</td>
</tr>
<tr>
<td>37.5 mm</td>
<td>95 - 100</td>
</tr>
<tr>
<td>26.5 mm</td>
<td>20 - 55</td>
</tr>
<tr>
<td>19.0 mm</td>
<td>0 - 10</td>
</tr>
</tbody>
</table>

• 75% of the aggregate by weight shall have 2 or more broken faces.

37.2 Soil Mix

The soil mix shall be 30-50% clay content (including the clay content of the first class topsoil) by dry weight, 30% peat by volume and the balance first class topsoil. The peat shall not contain any object larger in dimension than 30 mm.
38.0 ANNUAL BEDDING MIX

Annual bedding mix shall contain:
- 15% sand
- 10% compost
- 75% first class topsoil

To each cubic metre add 1.5kg dolomite lime.

If the mix will be planted within one month add 4kg specified slow release fertilizer.
## COMPLIANCE REQUIREMENTS CHECKSHEET – GENERAL

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CSS REF</th>
<th>TASK</th>
<th>TEST STD/ DESCRIPT</th>
<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
<th>ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONTRACTURAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>H&amp;S Act</td>
<td>H&amp;S</td>
<td>Inspect</td>
<td>Measures in place</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 5.1 QA and CQP</td>
<td>Inspect</td>
<td>Measures in place</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 5.2 Personnel</td>
<td>Inspect</td>
<td>Qualifications comply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 5.6 Construction records</td>
<td>Inspect</td>
<td>Records available for audit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>2</td>
<td>NOTICE BOARDS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 7.0 Notice board layout</td>
<td>Inspect</td>
<td>1200mm x 900mm, correct details</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 7.1 Preconstruction notice board installation</td>
<td>Inspect</td>
<td>Erected 2 weeks before work commences, lit and visible, not obstructing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 7.0 Construction notice board installation</td>
<td>Inspect</td>
<td>Erected before work commences, lit and visible, not obstructing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SITE MANAGEMENT</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pt 1 13.0 Noise</td>
<td>Inspect</td>
<td>Measures in place to control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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### PRIVATE PROPERTY

- **Agreements**
  - Pt 1
  - 15.1: Inspect
  - Written agreement prior to work

- **Notification**
  - Pt 1
  - 15.1: Inspect
  - Written notice given 14 days before work

- **Clearance**
  - Pt 1
  - 15.4: Inspect
  - Written clearance received

### POTABLE WATER CONTAMINATION

- **Potable water contamination**
  - Pt 1
  - 16.0: Inspect
  - Positive pressure maintained through damaged pipe

- **Standpipes**
  - Pt 1
  - 16.1: Inspect
  - Approved standpipes used

### EROSION SEDIMENT AND DUST CONTROL

- **Dust**
  - Pt 1
  - 18.1: Inspect
  - Measures in place to control

- **Land drainage water contamination**
  - Pt 1
  - 18.2: Inspect
  - Site complies with General Authorisation or specific resource consent

- **Water control**
  - Pt 1
  - 18.2: Inspect
  - All contaminants intercepted and controlled

### PROTECTION OF NATURAL ASSETS & HABITATS

- **Existing features**
  - Pt 1
  - 19.1: Inspect
  - Features to be preserved marked

- **Tree protection**
  - Pt 1
  - 19.3: Inspect
  - Complies with resource consent

- **Existing trees**
  - Pt 19.4: Inspect
  - Fence installed outside drip line prior. No trees removed unless identified

- **Tree roots**
  - Pt 1
  - 19.4.1: Inspect
  - Protective measures taken, hand or trenchless excavation near tree
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### EXCAVATION, BACKFILLING AND RESTORATION

<p>| Pt 1 28.0 | Excavation in legal road | RON | Complies with RON |
| Pt 1 29.1 | Backfilling in legal road | RON | Excavations shall be sealed within 5 days |
| Pt 1 29.2 | Trafficked area backfill | NZS 4402.4.1.1 | Compacted to 95% MDD |
| Pt 1 29.3 | Pedestrian area backfill | NZS 4402.4.1.1 | Compacted to 90% MDD |
| Pt 1 29.4 | Landscape area backfill | NZS 4402.4.1.1 | Compacted to 70% MDD |
| Pt 1 29.5 | QA | Inspect | Records kept and available |
| Pt 1 29.5.1 | Compaction tests | Measure | Test results on layers available |
| Pt 1 30.0 | Restoration and final surfacing - berms | Inspect | Complies with requirements in CSS Part 2 and 7 |
| Pt 1 30.0 | Restoration and final surfacing – plant beds | Inspect | Complies with requirements in CSS Part 2 and 7 |
| Pt 1 30.0 | Restoration and final surfacing - paths | Inspect | Complies with requirements in CSS Part 6 |
| Pt 1 30.0 | Restoration and final surfacing - road | Inspect | Complies with requirements in CSS Part 6 |
| Pt 1 30.1 | Restoration in legal road | WAP | Complies with requirements of WAP, sawcutting, resurfacing widths |
| Pt 1 | Lengths of open | Measure | 10m when offsite |</p>
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REQUEST TO WORK NEAR TRAM TRACKS

Tramways Permit No. __________

Contractor: ____________________________________________________________

Contractor’s address or Contractor’s agent: __________________________________

Phone No: Office __________ Fax __________

Mobile __________ After hours __________

Contractor’s STMS: _______________________________________________________

Description of work: ____________________________________________________

Period of work: From / / AM/PM To / / AM/PM

Location of work: _______________________________________________________

Contractor: ____________________________

signature

If work to be carried out is closer than 2.2m from the centreline of the tram tracks, these
additional conditions apply: ______________________________________________

__________________________________________

Christchurch Tramways: ____________________________

signature print name

Date: __________

Christchurch City Council: ____________________________

signature print name

Date: __________

Submit a copy of this form, signed by the Contractor and the Tramways Company, to
the Christchurch City Council along with the Traffic Management Plan for approval
prior to any work commencing.
**Trench Restoration**

**Type C1**
- Chipseal
- 100mm max overlap with grade 6 chip
- TNZ M/4:AP40 Min 150mm

**Type C2**
- Thin AC
- TNZ M/4:AP40 Min 150mm

**Type C3**
- Rigid Pavement
- CCC AC16 Min 50mm
- TNZ M/4:AP40 Min 150mm

**Type C4**
- Friction Course (P11)
- CCC AC16 : 50mm below friction course
- TNZ M/4:AP40 Min 150mm

**Type F1**
- Standard Footpath
- TNZ M/10:AC10 35mm
- TNZ M/4:AP40 Min 100mm
- TNZ M/10:AC10 35mm

**Type F2**
- Commercial Crossing
- TNZ M/4:AP40 Min 250mm

**Type F3**
- Grass Berms
- 100mm Topsoil

**Type F4**
- Gritted Berms
- Crushed AP7
- Stabilised AP20 100mm

---

*Note: Diagrams illustrate various trench restoration methods with specific material layers and minimum thickness requirements.*
NOTES:

1. Locate Bus Stop outside of vehicle crossings where possible.
2. Provide signage to comply with clause 23.1.
3. Provide pedestrian access to comply with CSS: Part I clause 23.0.
NOTES:

1) The drip line radius is the greater of the defined protected zone distances.

2) All requirements of CSS Part 1, clause 19.4 Protection of existing trees (including private trees) must be followed.
# CHRISTCHURCH CITY COUNCIL

# CONSTRUCTION STANDARD SPECIFICATION

## PART 2 – EARTHWORKS

CSS: PART 2 2013

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APPENDICES

1 Compliance Requirements Checksheet

STANDARD DETAILS

Berm Construction SD 201 Berm Construction
1.0 FOREWORD

This Specification forms Part 2 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General
CSS: Part 2 2013 - Earthworks
CSS: Part 3 2013 - Utility Drainage
CSS: Part 4 2013 - Water Supply
CSS: Part 5 2013 - Lights
CSS: Part 6 2013 - Roads
CSS: Part 7 2013 - Landscapes

Each part of the Standard Specification includes those Standard Details (SD) relating to that part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

NZS 4431: 1989 Code of practice for earth fill for residential development
NZS 8409: 2004 Management of agrichemicals
AS/NZS 3008.1.2:2010 Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand installation conditions
AS/NZS 2032: 2006 Installation of PVC pipe systems
AS/NZS 2033: 2008 Installation of polyethylene pipe systems
AS 2845.3: 2010 Water supply - Backflow prevention devices - Field testing and maintenance

The New Zealand Building Code Handbook and Approved Documents
3.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

Selected materials are specified in CSS: Part 1 - General.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

4.0 PROTECTION OF NATURAL ASSETS AND HABITATS

Note that all work adjacent to and affecting natural assets and habitats shall be carried out in accordance with the requirements of CSS: Part 1 - General.

5.0 SITE CLEARANCE

Unless otherwise specified, all vegetation and material shall be cleared from the site, removed and disposed of in a safe and legal manner. Areas where planting is to take place shall be cleared of all building materials, rubble, stones and refuse including glass, plastic, concrete etc to the satisfaction of the Engineer.

Removal of existing vegetation with herbicide shall precede cultivation by at least 14 days, unless otherwise specified. Herbicide use shall conform to clause 6.0 – Pesticide, Herbicide and Fertiliser Application. It is recommended that rank growth be trimmed to a maximum height of 100mm and the area left until fresh regrowth is apparent prior to spraying. This will reduce required spray rates and enhance the effectiveness of the spraying.

5.1 Measurement of Work and Basis of Payment

Site Clearance shall be paid as a lump sum. This shall include the removal of all vegetation, disposal off site, payment of any disposal fees and spraying of vegetation, unless otherwise specified. The removal of trees shall be a separately scheduled item.
6.0 PESTICIDE, HERBICIDE AND FERTILISER APPLICATION

6.1 Scope of Work

This specification is for the use of herbicides, insecticides, fungicides, fertilisers and their application.

6.2 Safety

*All pesticides and herbicides shall be applied in strict accordance with NZS 8409 “Code of practice for the management of agrichemicals” and the manufacturer’s instructions.*

Prior to the commencement of work, the Contractor shall present proof to the Engineer, in the Contract Quality Plan, that supervisory staff hold a current advanced applicator’s qualification and that all staff applying pesticides and herbicides hold a standard applicator’s qualification.

6.3 Pesticides and Herbicides

*Pesticides and herbicides shall be specified.*

Use of herbicides shall be strictly controlled to prevent bank instability due to a lack of vegetation.

In general, herbicide shall not be used to control vegetation alongside waterways where the vegetation is maintained by the adjacent landowner. This particularly applies to private property, enhancement areas and road frontages.

6.4 Application

*The Contractor shall ensure that no pollution of any watercourse or water supply occurs during spraying operations and shall be held responsible for any such pollution. The Contractor shall make good any damage caused by pollution, drift or excessive rates of application and shall be held responsible for any claims for compensation arising from their actions or omissions.*

Before boom spraying of turf areas, the Contractor shall notify the Engineer, giving at least two days notice of their first intention and eight hours of their final intention.

6.5 Notification and Signage

*Further to Appendix M, NZS 8409 “Code of practice for the management of agrichemicals”, signs shall have a surface area of 0.5m² and shall be white with black lettering. Lettering shall be 70mm high and shall say ‘Park/area Closed for Turf/weed Spraying, for inquiries contact (Contractor’s Name and 24 hour phone number)’.*
Notification through newspapers, publicity leaflet drop or door-to-door notification is not required unless specified.

6.6 Measurement of Work and Basis of Payment

Pesticide, herbicide and fertiliser application will be measured per m$^2$, to the nearest m$^2$. Application shall include the provision of signage and staff monitoring of sprayed areas.

7.0 IRRIGATION

7.1 Scope of Work

This specification is for the supply and installation of irrigation reticulation.

7.2 Installation of Water Reticulation

All work shall be carried out in accordance with CSS: Part 4 – Water Supply unless otherwise specified.

7.3 Materials

On sloping sites, where sprinklers on the same line have an elevation difference of more than 300 mm, the sprinklers shall incorporate a built-in check valve.

All automatic valves shall be slow closing. For ease of maintenance, systems should preferably contain one brand of fittings.

7.4 Excavation

Trenches shall be free from any objects that would endanger the bedding of the pipes.

7.4.1 Length of Open Trench
The Contractor shall not have more than 10 metres of trench open when offsite.

7.4.2 Bedding
Where specified, PVC-u pipes shall be laid on a minimum 50mm of specified bedding and shall be uniformly supported throughout their length.

7.4.3 Cover Over Pipes
The top of the pipe shall have not less than 300mm cover at all times, unless approved by the Engineer.
7.5 Cleanliness

Open pipes shall be blocked off each night after the days work to prevent debris from entering the system.

7.6 Installation

7.6.1 Pipelaying
Pipe shall be installed within 300mm of the specified location and with the minimum specified cover.

7.6.2 Jointing
Cleaning fluid shall be used prior to gluing of PVC pipes and joints.

7.6.3 Fittings
Backflow preventers shall be installed in accordance with Section G12 AS1 (3.6.3 & 4) of the “New Zealand Building Code Handbook and Approved Documents”.

All backflow preventers shall undergo a commissioning test in accordance with AS 2845.3 “Water supply - Backflow prevention devices - Field testing and maintenance” testing instructions at the time of installation. All tests shall be recorded, with the specified backflow preventer reference number, on Appendix G & H of AS 2845.3 and the results forwarded to the Engineer.

Sprinkler units shall be installed at the correct level in accordance with the manufacturer’s specifications.

7.6.4 Surface Boxes
Surface boxes shall be firmly bedded and accurately positioned. The box shall protrude not more than 5mm above the surface and shall lie parallel to the plane of the finished surface. Solenoid valve boxes shall be buried with the lid a minimum of 75 mm below ground level.

7.6.5 Thrust Blocks
A concrete thrust block shall be constructed in accordance with CSS: Part 4, clause 12.4 – Thrust Blocks.

7.7 Wiring

All wiring shall comply with the AS/NZS 3008.1.2 “Electrical installations - Selection of cables Part 1.2: Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand installation conditions”.

Wire shall run in continuous lengths between the controller and the first valve and between valves. Wire joints shall be located in the valve boxes. All joints shall be adequately sealed against moisture penetration.
Wires shall be laid where possible below or beside the pipe reticulation system in a common trench. Sufficient wire shall be left at valves to enable future replacement of valves without the need for excessive jointing of wires.

7.8 As-Built Records

The Contractor shall ensure that any electrical wiring that is not installed concurrently in the water trench is picked up.

This pickup shall occur in accordance with CSS: Part 4, clause 20.0 – As-Built Records and IDS: Part 12 – As-Built Records.

7.9 Backfill

The Contractor shall notify the Engineer 24 hours prior to commencing backfilling. Backfill shall be in accordance with CSS: Part 1 - General, including compaction. Backfill shall be the specified imported material, unless the Engineer approves the use of the excavated material as backfill.

7.9.1 Bedding

Bedding shall be placed to a depth of 100mm over the pipe, where specified.

7.9.2 Metallic Detector Tape

A metallic detector tape, printed with the words “Water Pipe Below”, shall be laid 150 to 250 mm below the finished surface over the installed pipe, where specified.

7.9.3 Restoration

In lawn areas a minimum 150mm of topsoil shall be placed to the trench. The trench shall be sown with the specified lawn seed and established in accordance with CSS: Part 7 - Landscapes. The finished grassed surface shall be in accordance with the requirements of clause 9.0 – Topsoil Placement.

The trench may be overfilled at construction to allow for settlement. The criteria set out in clause 9.5 – Topsoiling and Finishing will therefore only apply to depressions at this stage.

In other areas metalcourses, final surfacing and the finished surface shall be in accordance with the requirements of CSS: Part 6 - Roads.
7.10 Operation of the Irrigation System

The Contractor shall provide the Engineer with an operating manual for the controller and operating instructions for the complete irrigation system.

7.11 Measurement of Work and Basis of Payment

Irrigation shall be paid as a lump sum unless otherwise specified.

7.11.1 As Built Records
There will be no additional payment for the provision of as-built records.

7.11.2 Operation of the Irrigation System
There will be no payment for the provision of instruction in the operation of the irrigation system.

8.0 EARTHWORKS

8.1 Scope of Work

This specification is for excavation, filling and grading prior to placement of topsoil in accordance with the following specification.

8.2 Site Management

The Contractor shall carry out the works to prevent water contamination, protect the existing subsoil structures and prevent excessive soil structural damage and avoid creating a dust nuisance. The Contractor shall restrict earthmoving machinery and stockpiles to areas and routes agreed with the Engineer. Full restoration of trafficked routes and stockpile sites shall be carried out at the completion of the works.

This clause shall be read in conjunction with CSS: Part 1 - General, particularly clause 18.0 – Erosion, Sediment and Dust Control. If the requirement to adhere to Environment Canterbury’s General Authorisation cannot be met, the Contractor may obtain resource consent for these works, at their cost.

The Contractor shall use alternative plant, alter the mode of operation and/or cease operations where pugging, sponging or plasticity of the site’s soils occurs. Earthworks shall not be carried out if the weather conditions are unsuitable. Work involving soil handling must not continue during rain, drizzle or any other free water conditions excepting work within waterways or excavations below groundwater.

The Contractor shall protect all cut and fill surfaces for the duration of the contract and defects liability period. Excessive waterlogging of surface
materials and the concentration of stormwater over sloped batters shall be prevented. If necessary the Contractor shall immediately make good, at their cost, any erosion/slumping that occurs as a consequence of the weather or from stream flows in waterway works.

8.3 Topsoil Stripping

Unless otherwise specified existing topsoil and peat shall remain the property of the Principal.

The Contractor shall determine the topsoil depth prior to stripping. Topsoil shall be stripped from all earthwork areas in a separate operation and handled and stockpiled separately to avoid contamination with subgrade or unsuitable materials.

8.4 Excavation

*Excavation shall be as specified. Excavation beyond the limits specified shall be made good in accordance with the Engineer’s requirements and at the Contractor’s cost.*

It is the Contractor’s responsibility to ensure they fully understand the extent of any earthworks required. The Contractor shall check the specification for any site-specific requirements.

No stripping or stockpiling shall be undertaken without the approval of the Engineer.

Works within water or below the water table will require short term stockpiling of saturated material to allow drying before placement as fill or trucking to waste.

Proposed topsoiled areas in existing carriageways (or otherwise unsuitable material) shall be excavated down to natural or suitable ground where possible, but total excavations (for construction plus undercut) shall not exceed 225mm in lawn areas, 600mm in plant beds and up to a depth of 1000mm for tree pits. The subgrade must also allow adequate drainage; therefore impermeable soils below these levels shall be ripped or broken.

Where granular road construction metals still exist below these levels, the Contractor shall inform the Engineer. The Engineer may instruct the Contractor to remove the remaining road construction metals and rip to 500mm depth, or add silt loam material, which shall be mixed to the full depth of the metals to ensure planting areas above are not excessively drained.

Where underground services are put at risk by subsoil ripping, the ripping shall not be undertaken.
Where the excavation for new berm is within existing sealed areas the seal shall be cut prior to excavation and battens shall be installed along the edge of the sealed area. Battens and any repairs to the sealed area shall be carried out in accordance with CSS: Part 6 - Roads.

8.5 Unsuitable Foundations

The Contractor shall advise the Engineer of any areas considered unsuitable as foundations. These may include former dump areas, within drain inverts, under heavy vegetation, behind timbering or redundant metalcourses under proposed landscape areas. The Engineer may order the removal of these unsuitable foundations.

8.6 Springs

Should any springs be uncovered during excavation work, they shall be protected and the Engineer notified.

8.7 Filling

All controlled filling shall be carried out in accordance with NZS 4431 “Code of practice for earth fill for residential development” section 8 ‘Construction Procedures’ excluding requirements for ‘Revegetation’ (clause 8.5), which shall be specified.

Technical responsibilities, choice of and quality control of filling material, inspection and control of filling and final certification shall be as specified.

Prior to placing uncontrolled fill over pasture, the existing grass shall be cut as short as possible and clippings removed.

8.8 Grading

Final formation shall be regular, pleasing to the eye, within the specified tolerances of the levels shown, unless otherwise required.

Grades not otherwise indicated on the plans shall generally be even, flowing slopes between paths, kerbs and other points. All grading and shaping of land shall provide effective surface drainage.

Minor shaping may be required to soften and naturalise the landscape, beyond the specified engineering profiles. The Contractor shall co-operate fully in implementing final shaping works.

8.9 Measurement of Work and Basis of Payment

Quantities scheduled are solid measure based on contours, longitudinal sections and cross-sections. No allowance has been or will be made for
bulking or saturation of cut material. Stockpiling of saturated material prior to placement or disposal and minor shaping shall be included in the rates. Any major reshaping ordered shall be treated as a variation.

Payment shall be per lump sum for total cut and fill items 8.9.3, 8.9.4 and 8.9.5. The Contractor shall satisfy themselves that the quantities proposed for cut and fill items are correct prior to formal contract agreement or other agreed period.

Truck measure will not be accepted as proof of variation of quantities.

8.9.1 Site Management
Site management shall be paid as a lump sum where specified, otherwise site management shall be included in the rates for the relevant items being constructed. The rate shall include any measures necessary under ‘Water Contamination and Control’ and ‘Dust Nuisance’ and shall cover the period from the commencement of the work until the issue of the Defects Liability Certificate.

There will be no additional payment for restrictions imposed on the Contractor under clause 8.2 – Site Management.

No increased payment shall be granted for extensions of time due to weather conditions but a pro-rata payment may be approved where variations sought by the Engineer specifically require an extended period of site management.

8.9.2 Topsoil Stripping
Topsoil stripping shall be paid by m², to the nearest m². The rate shall include excavation and stockpiling where necessary.

8.9.3 Cut to Waste
Cut to waste shall be measured by the m³ solid volume excavated, to the nearest m³, and shall be paid by lump sum, as detailed above. The rate shall include any dewatering or drainage control necessary, excavation and disposal off site.

Stumps encountered shall be considered part of the cut to waste material and shall not be cause for additional payment.

8.9.4 Cut to Fill
Cut to fill shall be measured by the m³ solid volume placed, to the nearest m³, and shall be paid by lump sum, as detailed above. The rate shall include any dewatering or drainage control necessary, excavation, stockpiling where necessary, scarification of underlying or intermediate layers of fill, placement to design levels in layers, compaction and minor shaping where required.
Cut to stockpile shall also include transport.

8.9.5 **Imported Fill**
Imported fill shall be paid by the $m^3$ solid volume placed, to the nearest $m^3$. The rate shall include any dewatering or drainage control necessary, excavation, supply, placement to design levels, compaction and minor shaping where required.

8.9.6 **Unsuitable Foundations**
The excavation of unsuitable foundations shall be paid per $m^3$ solid volume of excavation approved, to the nearest $m^3$, and shall include disposal.

Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

Extra excavation of road metal (unsuitable foundations) under berms, plant beds and tree pits shall be paid by the $m^3$ as above or by $m^2$ excavated to the specified depth, as scheduled. Excavation shall include the disposal of the excavated material.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

8.9.7 **Testing**
Testing of fill materials that show compliance with the specified requirements shall be paid as specified.

8.9.8 **Excavation of Plant Beds**
Excavation of plant beds shall be paid per $m^2$ excavated to the specified depth, to the nearest $m^2$. Excavation shall include the disposal of the excavated material.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

8.9.9 **Excavation of Tree Pits**
Excavation of tree pits shall be included in the rate for topsoil placement to tree pits. Excavation shall include the disposal of the excavated material.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.
9.0 TOPSOIL PLACEMENT

9.1 Scope of Work

This specification is for the preparation of the subgrade, the placement of recovered or imported topsoil or structural soil and cultivation prior to planting or sowing.

9.2 Ripping, Cultivation and Scarifying

_Once subgrade levels are formed, soil areas shall be ripped to 500mm depth unless a lesser depth of cultivation is specified. Impermeable surfaces below landscape areas shall be ripped or cored to facilitate drainage. Areas that will be filled in accordance with NZS 4431 “Code of practice for earth fill for residential development” shall not be ripped._

Ripping and cultivation should generally conform to the contours of the land. Ripped areas shall be scarified to facilitate bonding of the growing medium and the subgrade.

Care shall be taken not to disturb the roots of plants that are to be retained.

The Engineer shall inspect the subgrade prior to placing of topsoil.

9.3 Preparation of Existing Landscape or Grassed Areas for New Lawn

Spray the specified herbicide to achieve total vegetation kill in accordance with clause 6.0 – Pesticide, Herbicide and Fertiliser Application. Where existing topsoil is of sufficient depth and quality, cultivate to an even depth of 75mm in berms and 100mm elsewhere to produce a fine tilth and an even surface.

Topdress any hollows with topsoil prior to seedbed preparation and sowing.

Where existing topsoil is of a substandard quality or is non-existent, a topsoil layer shall be provided to the specified depth.

9.4 Preparation of Existing Landscape or Grassed Areas for New Planting Beds

Spray the specified herbicide to achieve total vegetation kill in accordance with clause 6.0 – Pesticide, Herbicide and Fertiliser Application. Where existing topsoil is of sufficient depth and quality, cultivate to an even depth of 200mm to produce a fine tilth and an even surface.

Where existing topsoil is of a substandard quality or is non-existent, a topsoil layer shall be provided to the specified depth.
9.5 Topsoiling and Finishing

New lawn shall incorporate a minimum of 75mm consolidated thickness of first grade topsoil, unless specified otherwise. Planting beds shall incorporate a minimum of 300mm consolidated thickness of first grade topsoil, unless specified otherwise. No topsoil placement shall occur without the approval of the Engineer.

Formed subgrades shall not hold water. Stones or other debris greater than 30mm in any dimension and present on the surface shall be removed from site, unless otherwise approved.

The soil when moist shall be able to be cored to a depth of 200mm in lawn areas and to a depth of 500mm in planted areas, using a 25mm diameter hand held soil sampler.

Grades shall generally be even and flowing between paths, kerbs and other points. All grading and shaping of land shall provide effective surface drainage. The surface shall be finished with a smooth and uniform surface free of obvious hollows and humps. The topsoil shall be evenly and moderately consolidated to prevent subsequent settlement, without undue compaction.

Minor shaping may be required to soften and naturalise the waterway, beyond the specified engineering profiles. The Contractor shall co-operate fully in implementing final shaping works.

9.5.1 Waterways and Swales
Final formation and shaping shall be regular, pleasing to the eye and within 100mm of the levels shown, at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate, unless otherwise directed.

9.5.2 Lawn in Amenity Areas and Playing Fields
The gap, under a 3m straight-edge placed anywhere on the re-levelled surface shall not exceed 20mm at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate.

Areas at the boundary of the re-contoured area shall be graded to allow the finished surface to be married smoothly and naturally into the existing ground levels.

9.5.3 Berms
Topsoil and subgrade placement and treatment shall be in accordance with SD 201 for lawn areas.

Final formation shall be +10mm, -0mm of the specified levels, at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate.
9.5.4 **Tree Pits and Planting Beds**

Topsoil and subgrade placement and treatment shall be in accordance with SD 721 for planting beds or SD 701 for tree pits.

*Final formation shall be within +0mm, -20mm of the specified levels, at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate.*

9.5.5 **Trees in Structural Soil**

Structural soil shall be laid with a compacted air void percentage range of 23-30%.

Care shall be taken when placing the material that the fines are evenly distributed throughout the material.

### 9.6 Measurement of Work and Basis of Payment

9.6.1 **Topsoil Placement**

Topsoil placement shall be paid by m², to the nearest m², formed to the specified depth. The rate shall include ripping, cultivation, supply or transport from on-site stockpiles, testing if required, placing, consolidation, scarifying and shaping.

9.6.2 **Second Class Topsoil**

Second class topsoil shall be measured by m³ solid volume placed, to the nearest m³. The rate shall include supply or transport from on-site stockpiles, testing if required, placing, compaction and trimming.

9.6.3 **Preparation of Existing Landscape or Grassed Areas for New Lawn**

Preparation shall be paid under the repair of existing lawn and shall include spraying with herbicide and cultivation. Imported topsoil and disposal of surplus material shall be paid by m³ solid volume, to the nearest m³.

9.6.4 **Preparation of Existing Landscape or Grassed Areas for New Planting Beds**

Preparation shall be paid by m², to the nearest m² and shall include spraying with herbicide and cultivation.

9.6.5 **Tree Pits**

Tree pits shall be paid per pit and shall include excavation and disposal of spoil, ripping, cultivation, supply of topsoil or transport from on-site stockpiles, placing, consolidation and shaping.
9.6.6 Plant Beds
Plant beds shall be paid per m², to the nearest m², and shall include ripping, cultivation, supply of topsoil or transport from on-site stockpiles, placing to the specified depth, consolidation and shaping.

9.6.7 Structural Soil
Structural soil shall be paid per m³ and shall include excavation and disposal of spoil, ripping, cultivation, supply of structural soil, placing, consolidation and shaping.

10.0 ПLACED STONE TO PROVIDE FACING, EROSION CONTROL OR AMENITY VALUE

10.1 Scope of Work
This specification is for the supply and placement of aggregate and stone or rock to form facings, to provide erosion control for waterways or to provide amenity value as part of land development.

10.2 Materials

Rock type shall be as specified. Stone shall conform to the dimensions as specified. All aggregate shall meet the requirements of CSS: Part 1 - General.

The Engineer shall approve all rock (stone) prior to its placement.

10.3 Placement

Larger rocks shall be placed at the base of the formation. Smaller rocks shall be placed to close voids and prevent loss of backfill. Each placed rock shall be stable, secure and well interlocked with adjacent rocks. Interlock shall be achieved by ensuring rock-to-rock contact between clean surfaces free of gravel or other debris.

Rocks shall be placed with rounded faces outwards.

10.3.1 Facing
Rock facing shall form an interlocking surface with an undulating natural looking profile.

10.3.2 Dry Stone Walls
Dry stone walls shall be constructed on a 200mm minimum depth compacted layer of specified aggregate, unless otherwise specified.

Geotextiles and free draining backfill shall be placed where specified.
10.4 Measurement of Work and Basis of Payment

10.4.1 **Stone**
Stone shall be paid per m\(^3\) solid measure, to the nearest 0.5m\(^3\), and shall include supply, sorting and placement unless otherwise specified.

10.4.2 **Aggregate**
Aggregate shall be paid per m\(^3\) solid measure, to the nearest 0.5m\(^3\), and shall include supply, placement, compaction and trimming unless otherwise specified.

10.4.3 **Geotextiles**
Geotextiles shall be paid per m\(^2\), to the nearest m\(^2\), and shall include supply and placement.
## COMPLIANCE REQUIREMENTS CHECKSHEET – EARTHWORKS

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STANDARD DETAILS

Iron Work Details
SD 301/1  Manhole Frames and Covers
SD 301/2  Manhole Vent & Trafficable House Drain Sump Frames & Covers
SD 301/3  Corner Sump Frame & Covers
SD 301/4  detail deleted Revision 8.0
SD 301/5  Wavy Sump Grating and Frame
SD 301/6  Standard Sump Grating and Frame
SD 301/7  Rectangular & Double Manhole Frames & Covers

Manholes
SD 302/1  Square Manholes Cast In-situ
SD 302/2  Square and Double Manhole Tops
SD 302/3  Square Manhole Tops Reinforcement
SD 303/1  Circular Precast Manholes for Pipes up to 400ø OD
SD 303/2  Circular Precast Manholes for Pipes up to 400ø OD - Top Slabs Reinforcement
SD 303/3  Square Base Precast Manholes for Pipes up to 750ø
SD 303/4  Benching Junctions and Laterals in Manholes
SD 304  Inaccessible Manhole
SD 305  Drop Structure in Manholes
SD 306/1  Manhole Raising Top Adjustment
SD 306/2  Manhole Raising Bottleneck Frame Adjustment

Flush Tanks
SD 311/1, 2  Flush Tanks
SD 312  Flush Manholes
SD 313  Air Gap Separator

Sumps
SD 321/1, 2  Side Entry Sumps - Precast Kerb Unit
SD 322/1 Side Entry Enlarged Sump
SD 322/2 Single Enlarged Sump
SD 323 detail deleted Revision 1.0
SD 324/1 Hillside Sump
SD 324/2 Special Entry to Double Sump in Hillside Channel
SD 325 Single & Double Sumps - Flat Channel
SD 326 detail deleted Revision 1.0
SD 327 Corner Sump
SD 328 House Drain Sump and Small Trafficable Sump
SD 329 Submerged Outlet

Under Channel Piping
SD 331 Concrete Surround for Under Channel Piping 225ø - 300ø
SD 332 Concrete Capping for Under Channel Piping 375ø - 525ø

Pipelaying
SD 341/1 Pipelaying at Manholes & Sumps Concrete and Ceramic Pipes
SD 341/2 Pipelaying at Manholes & Sumps for PVC up to 315ø
SD 341/3 Pipelaying at Manholes for PE Pipes
SD 341/4 Long Socket Manhole Connector
SD 342 Pipe Protection
SD 343 PVC Manhole Starters and Finishers
SD 344/1 Pipelaying Haunching Details for Concrete Pipes
SD 344/2 Pipelaying Haunching Details for Flexible and Ceramic Pipes
SD 344/3 Foundation Options
SD 345 detail renamed SD 344/2 Revision 1.0
SD 346 Pressure Pipelines - Thrust Blocks
SD 347 Water Stops
SD 348 detail renamed SD 342 Revision 1.0
SD 349 detail deleted Revision 1.0

Pipe Connections
SD 361 Direct Connections to Stormwater Pipe
SD 362 detail deleted Revision 1.0
SD 363 Pipelaying Junctions off Factory Moulded Riser
SD 364/1 PE Junctions – Swept Bends, Inspections & Adaptors
SD 364/2    PE Lateral to PVC Main Connector
SD 365    detail combined with SD 364 Revision 1.0

**Stormwater Structures**

SD 371/1    Concrete Headwalls
SD 371/2    Cut Pipe Rockwall
SD 372    Standard Reinforced Concrete Beam
SD 373    detail deleted Revision 7.0
SD 374/1, 2    detail deleted Revision 7.0
SD 375    Standard Inspection Chambers Type B and Type C
SD 376    Standard Circular Inspection Chamber
SD 377/1, 2    Subsoil Drains
SD 377/3    Subsoil Drain Pipes
SD 378    House Drain Inspection Box

**Miscellaneous**

SD 381    Vacuum Column Backflow Preventer
SD 382    Wastewater Spindle Cap
1.0 FOREWORD

This Specification forms Part 3 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General
CSS: Part 2 2013 - Earthworks
CSS: Part 3 2013 - Utility Drainage
CSS: Part 4 2013 - Water Supply
CSS: Part 5 2013 - Lights
CSS: Part 6 2013 - Roads
CSS: Part 7 2013 - Landscapes

Part 3 of the Standard Specification includes the Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

NZS 3101:2006 Concrete structures standard
NZS 3109: 1997 Concrete construction
NZS 3114: 1987 Specification for concrete surface finishes
NZS 5821.2: 1981 Plain language code of practice for the safe use of lasers in surveying, levelling and alignment
AS/NZS 1554.3: 2008 Structural steel welding - Welding of reinforcing steel
AS/NZS 2032: 2006 Installation of PVC pipe systems
AS/NZS 2033: 2008 Installation of polyethylene pipe systems
AS/NZS 2566.2: 2002 Buried flexible pipelines - Installation
AS/NZS 4671: 2001 Steel reinforcing materials
AS 3996: 2006 Access covers and grates
ISO 13953: 2001 Polyethylene (PE) pipes and fittings -- Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

ISO 13954:1997 Plastics pipes and fittings -- Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm

ISO 13955:1997 Plastics pipes and fittings -- Crushing decohesion test for polyethylene (PE) electrofusion assemblies

ASTM F2620 - 12 Standard Practice for Heat Fusion Joining of Polyethylene Pipe Fittings

WIS 4-32-08 UK Water Industry Specification for the Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE 80 and PE 100 Materials (may be referred to for general guidance)

Transit New Zealand Standard Specifications


Christchurch City Council Schedule of Local and Special Conditions to the National Code for Utility Operators’ Access to Transport Corridors 2013

Christchurch City Council CCTV for Christchurch City Council Earthquake Recovery

Water Services Association of Australia WSA-06 Vacuum Sewerage Code of Australia

American Prestressed Concrete Institute Recommended Practice for Erection of Precast Concrete: 1985


3.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, EQUIPMENT, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

Selected materials are specified in CSS: Part 1 - General. All pipe and fittings shall be approved.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

Imported lime stabilised fill materials shall be centrally batched off site. Site batching shall only be permitted at the discretion of the Engineer and when the Engineer is satisfied that there is appropriate equipment and space on site for thorough mixing and that a lime dust nuisance will not be created for adjacent residential properties.

*All fittings shall have a pressure rating at least equivalent to the rating of the adjacent pipe.*

All pipe diameters are nominal internal, unless specifically stated otherwise.

4.0 PRIVATE PROPERTY

Where works are to be constructed in private property, the Council, and hence the Contractor as the Council’s agent, has the power to enter the land subject always to the requirements of CSS: Part 1 - General and the following conditions.

4.1 Progress of Work

In order to hasten the work, rapid hardening cement and precast manholes and/or tops shall be used where possible.

4.2 Planting and Existing Structures

The Contractor shall remove trees and shrubs along the trench line before excavation starts. New trees and shrubs shall be planted after the surface restoration is completed where the owner desires. The Contractor shall replace any of these plants that die, in accordance with CSS: Part 7 - Landscapes.
Care shall be taken not to damage trees and shrubs that are not on the trench line. The Contractor shall be held responsible for any damage. The Contractor shall replace any hedges alongside or crossing the worksite that die. Where mature plants are replaced with smaller plants, temporary fencing shall be installed at the Contractor’s cost and to the property owner’s approval, if requested by the owner.

4.3 Excavated Material

The Contractor shall remove all topsoil along the line of the trench and stockpile it clear of the trench in an approved position so that it does not become mixed with other materials.

All excavated material shall be placed only where approved to minimise damage to lawns, garden etc. In some cases this may mean temporarily removing the spoil from the property.

Surplus excavated material and/or topsoil shall not be removed from the property without the approval of the owner. Material required by the owner shall be stockpiled in a location adjacent to the works as instructed by the owner.

4.4 Approved Equipment

Mechanical equipment that is approved by the Engineer can be used on private property except where the use of mechanical equipment is expressly excluded in the General Specification.

4.5 Temporary Fencing

The installation and maintenance of such temporary fencing as may be required to ensure the safety and security of the property owner and/or occupier shall be provided at the Contractor’s cost.

4.6 Measurement of Work and Basis of Payment

All site clearance, excavation, stockpiling and reinstatement on private property shall be included in the rate for the item concerned. There will be no payment for temporary fencing or replacement of plants damaged by the Contractor’s operations.

The planting and establishment of trees and shrubs to replace removed plants shall be paid per item. The rate shall include the formation of planting holes, supply of plants and additional compost where required.
5.0 EXISTING SERVICES

5.1 Support of Services

The Contractor shall support all services affected by the operations, whether these services cross or are alongside the excavation. Support shall be in accordance with the requirements of the service authorities concerned. All power poles destabilised by the Contractor’s excavations shall be provided with additional support.

The requirements of this clause are additional to CSS: Part 1 - General.

5.1.1 Live Laterals Crossing the Excavation
100mm sanitary sewer and stormwater laterals crossing the trench shall be supported temporarily and kept functioning. Prior to completion of backfilling these laterals shall be replaced in accordance with clause 11.0 - Laterals, where directed. The replacement shall extend as far as required into undisturbed ground and sanitary sewer laterals shall have an inspection pipe installed at one end.

5.1.2 Support of Sewer or Stormwater Pipes Crossing the Excavation
Sewer or stormwater pipes shall be supported by extending the haunching metal around the new pipe and up to the pipe being supported so it is correctly haunched in accordance with SD 344 Haunching Type M.

5.1.3 Asbestos Watermains
When trenching for pipe sizes exceeding 110mm diameter exposes an existing AC watermain and while the original pipe is exposed across the excavation, it shall be temporarily supported by a steel or wooden beam which spans the trench.

Where the length exposed of an existing AC watermain of 200mm diameter or smaller is greater than 800mm, the following support will be provided:

a) The pipe shall be further exposed on each side of the trench, and the length of AC pipe crossing the trench plus an additional 750mm each side, shall be cut out and replaced with PN16 PVC-u pipe of the equivalent size.

or

b) Low strength flowable concrete, at least 600mm deep, shall be poured below the pipe to directly support it but no higher than mid-height of the pipe. The AC pipe shall be wrapped in polythene film prior to the concrete being poured to prevent the concrete adhering to the pipe.

Where the length exposed of an existing AC watermain of a diameter larger than 200mm is greater than 1200mm:
a) The pipe shall be further exposed on each side of the trench, and the length of AC pipe crossing the trench plus an additional 750mm each side shall be cut out and replaced with Ductile Iron pipe of the equivalent size. Alternatively, the pipe may be replaced with a pipe material selected in accordance with IDS: Part 7 - Water Supply, Appendix 2.

or

b) Low strength flowable concrete, at least 600mm deep, shall be poured below the pipe to directly support it but no higher than mid-height of the pipe. The AC pipe shall be wrapped in polythene film prior to the concrete being poured to prevent the concrete adhering to the pipe.

5.2 Service Conflicts

5.2.1 Abandoned Services
Treat abandoned services that clash with the new pipeline in accordance with clause 5.3.1 – Clashing services.

5.2.2 Live Laterals Fouled by the Proposed Pipeline
Where the proposed pipeline fouls 100mm diameter laterals they shall be re-laid as necessary to clear the pipeline. Wherever possible the laterals shall be re-laid to a true grade falling continuously. No siphons shall be constructed.

5.2.3 Unavoidable Diversion of Services
A clash in location between services and the permanent work may necessitate the diversion and reinstatement of the service. A clash in the form of coincident position and not merely proximity will be the sole reason for the Engineer ordering this diversion.

5.2.4 Clearance to Other Services
Where the clearance between existing services and the proposed pipeline is limited, the Contractor shall arrange the lay, by incorporating short pipes, to maximise the clearance available.

5.3 Redundant and Abandoned Services

5.3.1 Clashing Services
Where abandoned services clash with new pipelines, the abandoned service shall be cut and sealed to the satisfaction of the particular service authority and the Engineer. Abandoned pipelines shall be sealed with a concrete plug at all points where they are cut and at all structures.

5.3.2 Manholes
Redundant manholes shall be treated by removing the top, breaking the walls down to 500mm below the finished ground
surface and backfilling the void with compacted CCC AP65. All connections shall be sealed with concrete.

5.3.3 Wastewater and stormwater pipes
Where treatment of abandoned wastewater and stormwater pipes has been specified pipes shall be either removed or filled:
- Removal - All pipes, including laterals, shall be removed and the trench backfilled to the requirements of clause 15.0 - Backfilling.
- Filling – Pipes shall be filled with a flowable fill or concrete of 1.5MPa strength. The volume of material inserted into the pipe shall be equal to or greater than the volume of pipe being abandoned. Before filling commences all connections to the pipe shall be sealed. If connected pipes are not sealed, their volume shall be included in the volume of material inserted.

5.4 Measurement of Works and Basis of Payment

5.4.1 Support of Services Alongside the Excavation
The temporary or permanent support of cables, ducts, gas pipes and water pipes of 40mm outside diameter and less alongside the excavation shall be included in the rate for pipe installation. Support of services of diameters greater than this is scheduled separately.

5.4.2 Support of Power Poles
Support of power poles shall be included in the rate for pipe installation.

5.4.3 Support of Services Crossing the Excavation
Temporary or permanent support shall be paid per item. Support of services under 40mm diameter is included in the pipe installation rate.

5.4.4 Laterals Crossing the Excavation
Payment for replacement up to 0.5 metres outside the excavation shall be included in the rate for service support. Where the Engineer orders replacement beyond this, payment for the additional piping will be made at the rate for laterals.

5.4.5 Unavoidable Diversion of Services
Unless specified, the diversion and reinstatement of services will be a variation ordered in writing by the Engineer.

5.4.6 Clearance to Other Services
Where the Engineer has ordered the use of short pipes to increase clearances to existing services, the difference in pipe costs will be paid as a variation.
5.4.7 **Potholing Services**
Potholes shall be paid per pothole ordered.

5.4.8 **Clashing Services**
The plugging of abandoned services shall be paid as scheduled.

5.4.9 **Manholes**
Treatment of a manhole includes removing the top and the walls as specified, disposal and backfilling of the void. Manholes shall be measured per item.

5.4.10 **Wastewater and stormwater pipes**
Treatment of redundant pipes shall be per lineal metre to the nearest 0.1m. Removal of redundant pipes includes excavation and disposal, supply of backfill and compaction. Filling of redundant pipes includes pits, sealing of connected pipes if undertaken, supply and placement of filling material, supply of backfill to pits and compaction.

6.0 **EXCAVATION**

6.1 **Excavations in Legal Road**

*Excavations carried out in legal roads shall be carried out in accordance with CSS: Part 1 clause 28.0 - Excavation.*

6.2 **Temporary Sealing**

*Temporary sealing shall provide a safe trafficable surface for the duration of its existence.*

6.3 **Removal and Disposal of Surplus Excavated Material**

*Surplus material shall be removed from the site within 24 hours, or immediately if the material constitutes a hazard or nuisance, subject to the requirements of clause 4.3 – Excavated Material.*

Should the Contractor fail to remove surplus excavated material from the site, the Engineer may arrange such removal at their cost.

6.4 **Trench Excavation**

*Trenching shall have vertical sides unless otherwise approved by the Engineer.*
6.4.1 **Length of Open Trench**

The length of open trench shall not exceed the greater of one manhole length or 50m and when offsite this open trench shall be reduced to a maximum length of not more than 10 metres.

On the hillside, backfilling shall not be permitted for uncompleted pipe lengths less than 15 metres until the pipeline has been tested by the hydrostatic test. This length shall not be reduced unless the Engineer is satisfied that a reduction is necessary to carry out the work or to provide adequate and safe road widths for traffic purposes.

6.4.2 **Trench Width**

The minimum trench width shall be 300mm wider than the external diameter of the collar of the pipe being laid, providing the haunching metal is compacted under and at the sides of the pipe.

The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of foundation and haunching materials.

Dimension ‘G’ on SD 344 Sheets 1 & 2 is the trench width for which payment will normally be made. Dimension ‘N’ is the trench width necessary to accommodate extra trench support and is the greater of 900mm or ‘G’ + 200mm. The Engineer may approve trench widths greater than and including ‘N’. For 1600mm or larger diameter pipes laid in deep trenches, the Engineer may increase ‘G’ by up to 200mm to provide increased working space. Availability of bucket sizes shall not be considered when approving increased trench widths.

6.4.3 **Base of Excavation**

No construction or work upon the excavation bottom shall commence until the natural bottom of the excavation has been inspected and the method of treatment approved by the Engineer.

The base of the excavation shall be level and undisturbed. The removal of disturbed material and filling of any deficiencies, as the Engineer requires, shall be carried out by and at the Contractor’s cost where excavating below or disturbing the required bottom.

6.4.4 **Trench Support**

The Contractor shall provide trench support to comply with the requirements of the Occupational Safety and Health Service of the Department of Labour. The Contractor shall ensure that the sides of the trench are sufficiently supported so that cracking of the surrounding ground does not occur.
Any cracking that does occur shall be repaired at the Contractor’s cost to the standards of the controlling authority or property owner.

Where trench support extends below the invert of the proposed pipeline or structure special precautions may be required, including leaving part of the support in place, to ensure the foundation of the pipe or structure is not weakened.

6.4.5 **Trench In An Existing Watercourse**

*Where the trench is in an existing watercourse, drain, or gully, etc, the Contractor shall strip all vegetation and organic material from the sides and bottom before placing foundations or backfill.*

6.4.6 **Installation of Geotextiles**

Should the trench bottom or sides be unsatisfactory, the Engineer may order an approved geotextile be placed prior to placing the foundation metal and during backfilling. Geotextiles shall be installed with laps as specified by the manufacturer.

6.5 **Excavations for Structures**

*Excavations for all structures must be of sufficient size to allow later removal of formwork and adequate compaction of backfill. However, in suitable stable ground the excavation may be made to the exact size required, the concrete being poured against the exposed surfaces. A waterproof membrane shall cover these surfaces except where the Engineer considers that the membrane is not necessary.*

6.6 **Rock and Explosives**

6.6.1 **Rock Definition**

Rock is defined as inorganic material that cannot be excavated without the aid of explosives, drilling or rock breaking equipment. Isolated boulders, which cannot be excavated without the aid of explosives, drilling or rock breaking equipment, shall be included in this definition.

6.6.2 **Use of Explosives**

*Explosives shall not be used unless expressly approved in writing by the Engineer.*

This approval shall be dependent on the following conditions being met:

- Explosives and detonators shall be stored, handled and controlled in accordance with statutory requirements and Local Authority Bylaws.
• Any damage caused by blasting operations shall be made good at the Contractor's expense.
• The Engineer shall approve the time at which shots are to be fired and shall be notified in writing 24 hours in advance of firing. Evidence must be produced at that time by the Contractor to show of compliance with Statutes and Regulations.
• Explosives shall be used only in moderate charges.
• Every charge and all ground that might be shattered shall be adequately covered to prevent fragments flying.
• All householders and the general public in the danger area shall be warned of, and kept from, any risk.
• Traffic in the danger area shall be stopped, or diverted, while there is danger from the firing or clearing operation.
• Explosives shall be used only under the control of a competent person who is fully qualified under the relevant Regulations.

6.7 Dewatering

All dewatering shall be carried out in terms of CSS: Part 1 - General.

6.7.1 Keeping the Excavation Free of Water
Subsoil water shall be kept below the metal foundation.

Should the Contractor fail to take adequate steps to keep the subsoil water down, or should the Engineer consider the methods adopted by the Contractor are endangering the foundations of pipes, other services or structures, the Engineer shall require other methods to be adopted.

The Contractor shall be responsible for making good any lifting of the pipes due to the flooding of the trench.

6.7.2 Control of Pumped Water
No stormwater or groundwater shall be permitted to enter the sewer system. No sewage shall be discharged to the stormwater system or to the road surface.

The Contractor shall not permit any flooding of property, footpaths or roadways to result from their operations.

6.7.3 Dewatering of Peat
Dewatering of peat strata outside the trench shall not be permitted where services or structures etc may be endangered by shrinkage of the peat.
6.8 Stumps and Subsurface Objects

6.8.1 Stumps
A “stump” shall be defined as a stump, root, branch or any part of a tree within the excavation that cannot be removed, or prevents the installation of trench support, by the equipment in use at the time, including an axe and a hand saw, provided that removal cannot be effected with the continuous efforts of all necessary manpower and equipment for 30 minutes.

6.8.2 Subsurface Objects
When man-made or man-placed subsurface objects including abandoned services, unknown or not previously located, adversely affect an excavation, the removal of such obstructions shall be paid as a variation, with quantities agreed with the Engineer.

6.9 Measurement of Works and Basis of Payment

6.9.1 Excavation
Excavation shall include the cost of sawcutting, excavation to the underside of the foundations and to trench width ‘G’ or ‘N’, keeping the excavation free of water, trench support, sorting of excavated material, disposal of surplus excavated material and all incidental work. Excavation shall be included in the rate for the relevant scheduled item.

The Engineer shall determine whether dimension ‘G’ or ‘N’ will be used in determining payment, where ground conditions and trench depth are such that trench support is appropriate.

The Contractor shall meet the cost of any additional excavation, crushed metal, imported backfill, change of pipe class, or any other measures required where excavating to trench widths greater than that approved.

6.9.2 Unsuitable Foundations
Unsuitable foundations shall be paid as a solid measure, to the nearest 0.1m³, the quantities being fixed by the depth, length and width of the excavation agreed. Unsuitable foundations shall include disposal of the excavated material.

6.9.3 Temporary Sealing
Temporary seal shall be paid by the lineal metre of trench sealed, to the nearest metre.
6.9.4 **Trench In An Existing Watercourse**
Where the existing watercourse is wider than trench width ‘G’, payment shall be made for the solid measure of imported backfill, to the nearest 0.1m³, calculated on the actual width of the trench.

6.9.5 **Installation of Geotextiles**
Geotextiles shall be measured by the square metre of surface covered, to the nearest m². This area is to the trench width as detailed in clause 6.9.1 - Excavation above and to the depth as ordered by the Engineer. This rate shall allow for laps in accordance with the manufacturer’s specification.

6.9.6 **Trench Support Left in Position**
Trench support shall be measured on the horizontal length installed on each side of the excavation, to the nearest metre. Trench support left in position by the written order of the Engineer, as a variation, shall be paid at the market rate ruling at the time of the order.

6.9.7 **Rock Excavation**
The Engineer shall measure rock quantities, to the nearest 0.1m³, before excavation. The Contractor shall remove the overburden for a reasonable length and notify the Engineer as soon as possible so that the volume of rock may be determined.

Payment will be based on the actual trench width up to a maximum of nominal outside pipe diameter plus 600mm. Where explosives are used, payment will be based on a minimum width of 900mm.

Rock excavation shall include disposal of excavated material.

6.9.8 **Keeping the Excavation Free of Water**
Keeping the excavation free of water, including the provision of pumps etc shall be included in the item for excavation. The Contractor shall provide and use all equipment necessary for the purpose.

6.9.9 **Stumps and Subsurface Objects**
The removal of a stump includes excavation, disposal and backfilling of the void with approved excavated material. Stumps shall be measured by item.

Where a stump enters the excavation more than once or where more than one part of the stump is in the trench, only one unit of payment will be made for the stump, unless the different parts enter the trench separately and must be removed separately.
7.0 JOINTING

Jointing shall be carried out to present a smooth invert surface between pipes.

7.1 Mechanical Jointing

Jointing shall be strictly in accordance with the manufacturer's instructions and to the Engineer's satisfaction. No jointing will be permitted under water unless expressly approved in writing by the Engineer.

Gibault joints and any other exposed metal components shall be thoroughly wrapped in place with a petrolatum impregnated two layer tape system. Mastic filler shall be applied if necessary to fill voids and create a smooth surface for tape application. Primer, filler and tapes shall be applied in strict accordance with the manufacturer’s specifications.

7.2 Jointing of PVC-m and PVC-u Pipe

Jointing shall be carried out in accordance with AS/NZS 2032 “Installation of PVC pipe systems”, the manufacturer’s instructions and to the Engineer’s satisfaction. Only off-site solvent weld joints carried out by the manufacturer are permitted.

7.3 Thermoplastic Jointing of Polyethylene Pipe by Electrofusion Welding

Jointing shall be carried out by approved contractors in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems”, the approved methodology and the pipe manufacturer’s instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 14.4 – Polyethylene Pipe Weld Tests.

Electrofusion couplings are not an acceptable jointing method for sections of PE pipeline that will be pulled into place.

7.3.1 Methodology
The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan.

Individual methodologies shall be submitted for each diameter range and material being jointed. The jointing method contained in POP001 “Industry Guidelines for Electrofusion Jointing of PE Pipes and Fittings for Pressure Applications" should form the basis of the methodology.

7.3.2 Quality Assurance Records
The Contractor shall prepare a site welding log sheet template and submit this through the Contract Quality Plan. The log sheet
shall be used to provide a detailed record of all joints carried out. As a minimum, the site welding log sheet shall provide the specified and actual fusion and cooling times, ambient conditions and the actual temperature of the pipe and coupler prior to jointing, corresponding to each weld number and certification number. The log shall also clearly identify the location of each joint, unless the pipe is installed by trenchless methods.

The completed welding log shall be submitted to the Engineer as an as-built record.

A sample electrofusion welding log sheet is attached in Appendix 5.

7.3.3 Operator Qualifications
Electrofusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders hold a NZWETA or EXITO PE Electrofusion Welding Certificate received within the last two years and have proven experience on the pipe diameter range being welded.

A copy of the operator's qualifications and proof of their experience relevant to the pipe diameter range being welded (e.g. weld test results) shall be submitted through the Contract Quality Plan.

Diameter ranges are up to and including 280mm and over 280mm.

7.3.4 Equipment
Electrofusion jointing shall be carried out using automatic machinery designed for the pipe size. Manually operated welding machines are not acceptable. The machine shall not be changed without the Engineer's approval.

Two clamps supported on a frame shall ensure the alignment of the components and mating of the component ends. Re-rounding clamps of the appropriate size shall be used where necessary.

All equipment shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated regularly. The frequency at which this is carried out will be different for individual items of equipment and will also depend on usage, but should be at least once every 12 months. Guidance should be sought from the equipment manufacturer and a scheme of calibration and servicing implemented.

Particular attention shall be given to the control box, the generator and the peeling tools. The sharpness of the cutter head tools shall be monitored regularly and appropriate maintenance
work carried out whenever the jointing surfaces show visible signs of ridges or grooves. If they have aluminium facer plates, use a cleaner that will remove aluminium oxide.

Suitable protection against inclement weather shall be provided, to prevent water, dirt and dust contamination and differential cooling of the pipes and couplings. Adequate working space shall be provided around the pipe in the trench to allow peeling and installation of equipment.

7.3.5  Pipe Preparation
The spigot end of the component shall be cut square and all rough edges and swarf shall be removed from the pipe ends.

The maximum ‘out of roundness’ of the pipe shall be 1.5% of the internal diameter. The maximum allowable gap between butted ends within an electrofusion fitting shall comply with the fitting manufacturer’s requirements.

The pipe diameter and wall thickness shall be measured for compliance using the appropriate tools. Remove sections of the pipe experiencing pipe end reversion.

After cleaning pipe ends shall be peeled to 0.3mm depth and for a distance equal to half the length of the coupling plus 20mm to remove dirt and oxidation. This should be peeled to a smooth profile using a sharp rotational peeler. The exposed ends of the pipe strings shall be covered until cooling is complete, to prevent any air flow which may heat or cool the pipe. Covers on fittings shall be retained until immediately before welding.

All jointing surfaces shall be clean, dry and free of all contamination before being assembled. Iso-propyl alcohol complying with the manufacturer’s concentration requirements and a lint-free disposable wipe shall be used to remove any oil or grease films. Mark witness marks with a non-contaminating marker.

The pipe and coupler shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and coupling through the Contract Quality Plan.

7.3.6  Welding
Each electrofusion joint shall be identified with the operator's certification number, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet (refer appendices for an electrofusion log sheet example).
The manufacturer’s recommended Standard Fusion Times (SFT) shall be entered into the control box using the appropriate methods required by the type and model of control box.

- For automated systems, the resistor lead shall be connected to the resistor terminal pin of the coupling.
- For bar code systems, the light pen shall be wiped across the code panel to enter the fusion times.
- For magnetic card systems, the card shall be placed into the control unit reader to enter the fusion times.

The pipe and fittings shall be pre-heated to manufacturer’s requirements if required.

The pipes shall be restrained in position during welding at the centreline height of the coupling, to prevent movement and the application of stress during the fusion process. The pipes shall be horizontal either side of the clamps to prevent both pulling away from the coupling joint and the entry of water or dirt into the pipe, which may contaminate the weld zone.

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

7.3.7 Pipeline Recovery after Pulling in/Cooling of Heated Pipe
The polyethylene pipeline shall be allowed to recover from the effects of thermal expansion and installation stretching. The pipeline shall not be restrained by rigid connections until the pipeline temperature reaches ground or service temperature. Where the pipeline is installed by trenchless methods, a minimum period of 24 hours shall be allowed after installation before connecting the pipe to any rigid connections including previously installed pipelines, bends and valves.

7.4 Site Butt Fusion Jointing of Polyethylene Pipe and Fittings
Jointing shall be carried out by approved contractors in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems”, the approved methodology and the manufacturer’s instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 14.4 – Polyethylene Pipe Weld Tests.

Unless the manufacturer gives explicit permission and provides details of specific welding procedures, butt fusion jointing shall only be used to join pipes and fittings that are:

- composed of similar materials (PE 80 shall be welded to PE 80, PE 100 shall be welded to PE 100);
- the same nominal diameter;
the same wall thickness measured by Pressure Number (PN) or Standard Dimension Ratio (SDR).

The Contractor shall plan the jointing, installation and tensile testing to minimise the number of electrofusion couplers used.

7.4.1 Methodology

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan. Individual methodologies shall be submitted for each diameter, wall thickness and pipe material type being jointed.

The methodology shall detail the parameters, as listed in clause 7.4.2 – Quality Assurance Records, which are necessary to meet the requirements of this specification. It shall also reference the procedures applied to achieve consistent and high quality joints. This methodology shall include (but not necessarily be limited to) the following information:
- the make and model of the butt fusion jointing machine;
- the cylinder area;
- the weld method to be used (e.g. single phase or dual phase);
- the name and qualifications of the approved operator;
- details of the pressure gauge, including the make, dial diameter, pressure range, smallest graduation value and the date of last calibration;
- specific parameters for each nominal pipe diameter, wall thickness and pipe material type to be jointed;

The weld parameters contained in the latest version of POP003 “Industry Guidelines for Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters" should form the basis of the methodology.

Appendix 2 provides general requirements for site butt fusion jointing.

7.4.2 Quality Assurance Records

The Contractor shall prepare a site jointing log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site jointing log sheet shall provide the following details:
- Pipeline name/description
- Joint location, accurate enough to locate the joint within one pipe length, unless the pipe is pulled into place.
- Weld date and time
- Operator name and ID number
- Pipe nominal diameter
7.4.2  Welding Parameters

- **Pipe SDR or PN**
- **Pipe material (PE 80, PE 100)**
- **Pipe manufacturer’s name and pipe identification**
- **Wall thickness (t, nearest mm)**
- **Cooled bead height & width (mm)**
- **Confirmation that the weld parameters have been met (as below).**
- **Pipe annular area (A, mm²)**
- **Hydraulic cylinder area (a, mm²)**
- **Heater plate temperature (°C)**
- **Bead-up pressure (P1, kPa)**
- **Bead-up time (T1, seconds)**
- **Heat soak pressure (P2, kPa) (= drag pressure only)**
- **Heat soak time (T2, seconds)**
- **Change-over time (T3, seconds)**
- **Time to achieve welding pressure (T4, seconds)**
- **Welding and cooling pressure (P3, kPa)**
- **Cooling time (T5, seconds)**

The results shall be presented in tabular form, along with the printouts from the fusion jointing machine.

The completed welding log shall be submitted to the Engineer as an as-built record.

7.4.3  Operator Qualifications

Butt fusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders have a NZWETA or EXITO PE Butt Fusion Welding Certificate received within the last two years and shall have proven experience on the pipe diameter range being welded.

A copy of the operator’s qualifications and proof of their experience relevant to the pipe diameter range being welded (e.g. weld test results) shall be submitted through the Contract Quality Plan.

Diameter ranges are up to and including 280mm and over 280mm.

7.4.4  Equipment

The welder shall have previous experience on the nominated welding machine. The machine shall not be changed without the Engineer’s approval.

The machine shall have either automatic logging facilities incorporated or be retrofitted with suitable logging facilities.
All equipment, but particularly the electrically heated plate, shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated as recommended by the manufacturer. The pressure gauge shall be gradually readable to 10 kPa or less and calibrated at least within the last six months.

The heater plate shall be undamaged and temperature controlled to be between 205°C and 235°C over both sides of the whole plate. A portable surface probe pyrometer capable of measuring the plate surface temperature to ±1°C shall be used to confirm this.

The sharpness of the planer or facing tool shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves.

Suitable protection against inclement weather shall be provided, to prevent differential cooling of the pipes and dirt, dust or water contamination e.g. a tent.

Ancillary equipment shall include:
- the clamping device with one fixed and one movable clamp, supported on a rigid frame.
- pipe support rollers or skids.
- pipe end plugs or caps.
- the weld bead measuring gauge.
- iso-propyl and lint-free disposable wipes.
- a clean ground sheet or baseboard.

**7.4.5 Pipe Preparation**

The Contractor shall follow the approved welding methodology.

The pipe and fittings shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and fittings through the Contract Quality Plan.

All jointing surfaces, including the heater plate, shall be clean, dry and free of all contamination.

The proposed joint interface shall not show any misalignment of more than 1mm for pipe diameters between 90mm and 315mm and of 2mm for pipe diameters between 355mm and 630mm. The maximum allowable diametric mismatch ("step" in the pipe OD at any proposed butt fusion joint) is 10% of the measured wall thickness.
End gaps between faces to be welded shall not exceed the following values:

<table>
<thead>
<tr>
<th>Pipe Diameter DN (mm)</th>
<th>Minimum Gap (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 225</td>
<td>0.3</td>
</tr>
<tr>
<td>280 to 450</td>
<td>0.5</td>
</tr>
<tr>
<td>500 to 630</td>
<td>0.6</td>
</tr>
<tr>
<td>710 to 900</td>
<td>0.7</td>
</tr>
<tr>
<td>1000 and above</td>
<td>1.0</td>
</tr>
</tbody>
</table>

7.4.6 Welding
Each butt fusion joint shall be identified with the operator's certification number, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet (refer appendices for a log sheet example).

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

7.4.7 Bead Profile
The bead faces shall be smooth and free from pitting bubbles. If pipes are any colour other than black, there shall be no discolouration of the weld bead material.

The joint beads shall be rounded and uniformly sized around the entire pipe circumference. In general, the "V-groove" between the beads should not be deeper than half the bead height above the pipe wall. However, provided that each half of the final bead is of a similar size and shape and tensile testing shows that the strength and failure mode meet the requirements of this specification, the overall width and height of the bead should not be a critical factor in the assessment of a butt fusion joint. Guidelines from POP 003 for the joint bead width are:

<table>
<thead>
<tr>
<th>Minimum Wall Thickness (mm)</th>
<th>Width of Bead (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>9-12</td>
</tr>
<tr>
<td>13</td>
<td>10-14</td>
</tr>
<tr>
<td>16</td>
<td>11-15</td>
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<tr>
<td>18</td>
<td>12-16</td>
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<td>19</td>
<td>12-18</td>
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<tr>
<td>22</td>
<td>13-18</td>
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<tr>
<td>24</td>
<td>14-19</td>
</tr>
<tr>
<td>28</td>
<td>15-20</td>
</tr>
<tr>
<td>30</td>
<td>16-22</td>
</tr>
</tbody>
</table>
Internal beads shall be removed from gravity pipelines and from pressure pipelines on manufactured bends. The removal shall leave a smooth surface flush with the internal pipe wall. External beads shall not be removed, unless specified.

Bead removal in gravity pipes shall be confirmed by CCTV inspection in accordance with clause 14.2.6 – CCTV inspection.

7.4.8 Joint Failure during Handling and Installation
If a joint fails during handling and installation, the Contractor shall inform the Engineer immediately. The Contractor shall provide the Engineer with the failed joint identification number and details of proposed actions to determine if the failed joint is an isolated incident or if it is a symptom of a more widespread problem, through the provision of a Non-Conformance Report.

No further pipe installation shall take place until the corrective action is accepted.

7.5 Measurement of Works and Basis of Payment

Jointing shall be included in the pipe installation rate.

8.0 PIPE INSTALLATION

All pipes shall be laid in accordance with the relevant current code, as listed in clause 2.0 – Related Documents, and the manufacturer’s instructions.

Pipes shall not be backfilled until the Engineer has had sufficient opportunity to obtain as-built measurements, in accordance with CSS: Part 1 - General. The Contractor shall ensure that as-built measurements have been taken before backfilling.

Oval grid reinforced pipes shall be laid so that the lifting eye or the word “top” is uppermost.

8.1 Line and Level

Pipe inverts shall be laid to ±10mm of the design vertical alignment. Pipes shall be individually aligned to grade. Gravity pipes shall not be laid at a negative grade. Vacuum sewer pipes shall be laid within 0.05% of the design gradient.

Pipe alignments shall be positioned horizontally within the greater of 50mm or 5% of the pipe diameter from the location specified.

Under no circumstances shall the Contractor be permitted to locate or suspend centre lines from sight bars. An independent bar shall be used, placed as close to the ground as possible.
8.1.1 Lasers
Lasers shall:
- be self levelling within a range of ±5°.
- be robust and suitable for construction applications.
- be protected from the effects of vibration.

Self-levelling equipment shall be accurate to within +/-0.002% and shall be calibrated every 12 months.

Lasers should have a warning indication if the system is off-grade by more than 1mm in 10 metres.

8.1.2 Use of Lasers
Laser use shall comply with NZS 5821.2 “Plain language code of practice for the safe use of lasers in surveying, levelling and alignment”.

Regular checks shall be carried out of the laser to ensure that:
- the light beam is on grade.
- the light beam is on line.
- the light beam is set at the correct level above the invert of the pipe to be laid.

Level checks shall be made against the site datum at each new manhole.

If the laser beam is showing evidence of being affected by hot or cold air currents, the Contractor shall stop laying pipe and take all necessary steps to remedy the problem.

8.2 Cutting
Concrete pipes shall be cut with a stonemasons saw and exposed reinforcing coated with 5mm minimum depth of epoxy coating, applied strictly in accordance with the manufacturer’s instructions.

8.3 Cleanliness
Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, etc, shall be thoroughly cleaned before jointing.

8.4 Leaks
The Contractor shall repair all leaks noted within the contract or defects liability period, including pipelines that have passed performance tests.
8.5 Pipe Protection

**8.5.1 Haunching and Surround**

Haunching shall be in accordance with SD 344. Haunching and surround shall be compacted to the greater of the manufacturer’s requirements or a minimum dry density of 2,050kg/m³ at any point on any haunching constructed of M/4: AP20 materials.

Haunching to underchannel pipes shall be laid to ensure that excavation for the carriageway adjacent to the pipeline does not allow the collapse of the haunching or remove support for the concrete capping and kerb and channel.

Haunching and surround shall be thoroughly worked into place, particular care being taken to ensure that the material is thoroughly compacted under the full length of the pipe. Where the pipes are larger than 460mm diameter, material shall be compacted by a power vibrator. The foundation shall be lime stabilised where it would be subject to scouring.

In liquefaction prone areas the Engineer will require the haunching and foundation to be protected by an approved geotextile complying with TNZ F/7 strength Class C.

Nuclear densometer use shall comply with CSS: Part 1 clause 29.5.1 – Compaction testing. The dry density shall be determined in accordance with NZS 4402.4.1.3 “New Zealand vibrating hammer compaction test”.

**8.5.2 Concrete Capping**

Concrete capping to underchannel pipes shall be in accordance with SD 332. Concrete capping to underchannel piping shall be reinforced in commercial vehicle crossings only.

**8.5.3 Concrete Surround**

Concrete surround shall be in accordance with SD 342 except for underchannel pipes that shall be in accordance with SD 331. Concrete surround to underchannel piping shall be reinforced in commercial vehicle crossings only. PVC pipes shall not be concrete surrounded. Flotation of the pipe during the placement of concrete surround shall be prevented.

**8.5.4 Concrete Protection Slab to PVC Pipes**

Where cover over PVC pipes is less than the minimum as stated in clause 8.7 – Flexible Pipes, including temporarily under construction traffic, a concrete protection slab shall be constructed in accordance with SD 342.
8.5.5 Joint Formers
Contraction joints shall be formed in concrete capping and surround at pipe joints at a maximum spacing of 10m.

Joints can be formed by placing a spacer of soft board or equivalent in the concrete at the pipe joint.

8.5.6 Geotextiles
Geotextile supply, installation and measurement of works shall be in accordance with CSS: Part 6 clause 13.0 - Laying of Geotextiles and Geogrids.

Geotextile wrapping of joints shall extend at least 0.5m each side of the joint. The geotextile shall be snugly secured around the pipe with cable ties or similar.

8.5.7 Pipe foundations
Where soft ground foundations are specified for part of a manhole to manhole length, the foundation shall extend from the pipe joint before the length to be supported to the pipe joint past the end of the length to be supported.

8.6 Pipe Installation on Hillsides

8.6.1 Treatment of Under-runners
The Contractor shall notify the Engineer of any under–runners, erosion cavities or tunnel gullies encountered during excavation. The Engineer shall advise on under-runner treatment.

8.6.2 Water stops
Water stops shall be constructed in accordance with SD 347 or as specified.

8.7 Flexible Pipes

Unprotected PVC pipes shall have minimum cover of 750mm in roads and streets, 600mm in driveways and similar areas subject to traffic, and 500mm in footpaths, gardens and open country. Stormwater laterals that discharge to the kerb shall be laid with the maximum cover achievable, up to these requirements.

PVC piping shall be protected with 6mm thickness of Denso tape or 250 microns polyethylene film or equivalent where adjacent to concrete.

8.8 Pressure Pipelines

Pressure pipelines shall be haunched and laid in accordance with SD 344 and clause 8.5 – Pipe Protection. The full length of the pipe barrel shall bear continuously upon the haunching.
The bearing capacity of the side support material, for curved pipelines with approved deflection joints, shall be checked to confirm it exceeds the specified capacity.

8.8.1 Thrust blocks

Concrete thrust blocks shall be constructed either in accordance with SD 346 or as designed in the locations specified. Thrust blocks must have developed adequate compressive strength before the pipeline is pressure tested.

The thrust block dimensions specified are the minimum for installation at the specified pressure.

Thrust blocks shall be poured against natural ground. If this is not possible, approved material shall be carefully backfilled and compacted in layers around and behind the thrust block.

The bearing capacity of the natural or filled ground shall be checked, to ensure it complies with the design capacity, before construction. Proof of this testing shall be provided through the Inspection and Test Plan in the Contract Quality Plan.

8.8.2 Anchor blocks

Anchor blocks shall comply with CSS: Part 4 clause 12.5 – Gradient Anchor Blocks.

8.8.3 Valves and surface covers

Install valves in accordance with CSS: Part 4 clause 12.1.1 – Valves. Install surface boxes in accordance with CSS: Part 4 clause 12.1.3 - Surface boxes and SD 412. Triangular valve spindle caps complying with SD 382 shall be installed on all spindles.

Roadmark in accordance with CSS: Part 4 clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves. Pressure sewer system surface boxes shall be painted white.

8.9 Subsoil Drains

Subsoil drains shall be laid in accordance with SD 377. Subsoil pipes shall have minimum cover of 750mm within the roadway, 600mm in driveways and rights of way, and 500mm in other applications unless otherwise specified.
8.10 Pipelaying at Structures

8.10.1 **Yield Joints**
Yield joints shall be formed in accordance with SD 341. Yield joints at sumps shall be constructed with one short pipe and two yield joints.

Jointing of cut pipes to form a closure shall be avoided if possible. If such jointing is necessary, it shall be done with a gibault joint or with purpose built fittings provided by the pipe manufacturer.

Any adjustment of the length of the lay necessary to obtain yield joints at the structure shall be done to the approval of the Engineer.

8.10.2 **Underchannel Piping**
Yield joints shall be constructed on concrete capped underchannel piping at all sumps.

8.10.3 **Starters/Finishers**
Structures shall not leak at the interface with the starter or finisher. Special purpose rubber ring joint connectors shall be used as starters and finishers at all PVC yield joints.

8.10.4 **Polyethylene Connection to Manholes**
Connections to concrete access chambers shall be in accordance with SD 341/3. Plastic Chambers shall have an approved purpose made connection.

8.10.5 **Long Socket Connectors**
Flexible joints shall be formed in accordance with SD 341/4. No laterals shall be connected to the first pipe length laid into the long socket connector i.e. within 4.0m of the manhole. Ensure benching does not prevent the internal pipe moving into the manhole. The benching should be to a larger diameter than the long socket.

8.10.6 **Collector sewers**
Collector sewers shall enter both the upstream and downstream manholes when laid directly over the sewer main. Caps are not required on the upstream end of the collector sewer. Drop structures are not required on the outlet where there is less than 1.0m between the invert of the collector sewer and the sewer main.
8.11 Measurement of Works and Basis of Payment

8.11.1 Pipe Installation
Payment shall be per lineal metre, to the nearest 0.1m, based on the horizontal length of pipe installed. Lengths shall be measured from the centreline of the on-line structure or from the termination point of the pipeline e.g. headwall, inlet. All structures shall be regarded as “extra over” the pipe installation rate for payment purposes.

Each type of pipe shall be measured and paid separately.

Pipe installation shall include excavation, work around services, support of existing services under 40mm diameter, supplying and laying, haunching, jointing, geotextile wrapping to joints, pipe testing, backfill placing, compaction to subgrade level and compliance testing in accordance with clause 15.4 – Quality Assurance. The supply of imported backfill is scheduled separately.

8.11.2 Pipe Protection and Haunching
Haunching shall be included in the rate for pipe installation. Where haunching is scheduled separately, it shall be paid per lineal metre, to the nearest 0.1m.

Haunching shall include the supply and placing of all foundations, haunching and pipe surround materials. This includes to 150mm above the barrel for ceramic and flexible pipes in accordance with SD 344.

Concrete capping, surround and protection slabs are paid per lineal metre, to the nearest 0.1m, and shall include joint formers.

8.11.3 Geotextiles
Geotextile surrounds, cover over haunching materials and raft foundations shall be paid per lineal metre, to the nearest 0.1m, based on the horizontal length of pipe treated. Excavation, pipe installation, work around services and haunching are included in the rate for pipe installation.

Geotextile wrapping to pipe joints shall be included in the pipe installation rate.

Geotextiles shall include supply, installation, lacing or fixing and testing. No extra payment will be made for laps or returns. Soft ground geotextiles shall be paid per square metre of geotextile laid. Raft foundations include geogrid, geotextile and GC65-40.
8.11.4 **Treatment of Under-runners**
The treatment of under-runners shall be measured by the volume of fill placed, to the nearest 0.1m$^3$. This rate shall include any labour and equipment required to place this material.

8.11.5 **Water stops**
Payment shall be per item. Where water stops are modified, their cost will be adjusted in accordance with the rates provided.

8.11.6 **Thrust blocks**
Payment shall be per item. This shall include confirming through site testing the capacity of the ground on which the thrust block bears. Where thrust blocks are modified, their cost will be adjusted in accordance with the rates provided.

8.11.7 **Subsoil Drains**
Subsoil drains shall be paid in accordance with clause 8.11.1 – Pipe installation. Subsoil drains shall include the supply and placement of geotextiles.

8.11.8 **Pipelaying at Structures**
Pipelaying at structures shall be included in the pipe installation rate. This item shall include all short pipes and special connectors required.

9.0 **POLYETHYLENE PIPE INSTALLATION**

*All pipes shall be transported, haunched and installed in accordance with clause 8.0 – Pipe Installation, AS/NZS 2033 “Installation of polyethylene pipe systems” and the pipe manufacturer’s recommendations.*

9.1 **Pipe Installation by Trenchless Technology**

*Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe and 20% of the pipe wall thickness for gravity pipe. Pipe shall not be bent to a radius less than 35 times the pipe OD.*

*The specified allowable load on the pipe shall not be exceeded during pulling.*

Where gouging or notching exceeds the above limits or if buckling of the pipe occurs, that length of pipe shall be removed and a new section welded in at the nearest join.

The Contractor shall overtow the pipe by one lineal metre for each length of pulled pipe that is the greater of one manhole length or 200m. The excess pipe length shall be supplied to the Engineer for a visual inspection.
9.1.1 Polyethylene Pipe Installation by Pipebursting
Where the polyethylene pipe is to replace a live pipeline, the line to be burst shall be inspected by CCTV to locate all laterals and to check for any obstructions. Live laterals shall be confirmed through the use of dye.

9.1.2 Polyethylene Pipe Installation by Slip Lining
The host pipe shall be cleaned to provide a clear pipe diameter that passes the new polyethylene pipe without gouging or notching the pipe.

Disposal of the cleanings shall be carried out in accordance with CSS: Part 1 - General.

The Contractor shall not detrimentally affect the host pipe when cleaning it. The most effective method of cleaning steel pipes in Christchurch is through physical scraping.

Prior to any attempt to pull in the new polyethylene pipe a plug, no less than the diameter of the new pipe, shall be passed through the host pipe to ensure there is sufficient clearance.

9.1.3 Polyethylene Pipe Installation by Directional Drilling
The constructed pipe alignment shall not vary more than 100mm horizontally from the design alignment and the tolerance on the vertical alignment shall not exceed the specified amount except where the grade of the pipe is specified, in which case it shall be ±5mm from the design grade.

Cover to pipes of 100mm diameter or greater shall not be less than 750mm, unless approved by the Engineer. Cover to pipes smaller than 100mm in carriageways or where likely to be crossed by vehicles shall be 750mm and elsewhere cover shall be 450mm. The maximum cover shall be 2.0m, unless approved by the Engineer.

All liquid waste shall be disposed of in accordance with CSS: Part 1 - General.

Clearances to services shall be in accordance with the particular Utility Operator’s requirements. The Contractor shall be liable for damages to any underground services.

The Contractor shall accurately monitor the position of the drilling head to achieve the above requirements.
9.2 Access Pits

<table>
<thead>
<tr>
<th>Pit Depth</th>
<th>Minimum pit length for pipe diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>110mm</td>
</tr>
<tr>
<td>0.6</td>
<td>3.0</td>
</tr>
<tr>
<td>0.8</td>
<td>3.4</td>
</tr>
<tr>
<td>1.2</td>
<td>4.2</td>
</tr>
<tr>
<td>1.6</td>
<td>4.8</td>
</tr>
<tr>
<td>2.0</td>
<td>5.2</td>
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<tr>
<td>2.4</td>
<td>5.6</td>
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<tr>
<td>2.8</td>
<td>6.0</td>
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<tr>
<td>3.2</td>
<td>6.2</td>
</tr>
<tr>
<td>3.6</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Assumptions:

a) New pipe is parallel with the road at the start of the pit and parallel (and in line) with the old pipe at the end of the pit. If this does not apply, calculate the minimum pit length from (b).
b) Table is based on a minimum PE pipe bend radius of 35 times pipe OD.

Pipes shall be haunched through any pits in accordance with clause 8.0 – Pipe Installation.

9.3 Pressure Sewer Systems

90 degree deflections on pressure laterals shall be constructed using two individual bends of 45 degrees.

9.4 Measurement of Works and Basis of Payment

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for a one-metre sample only.

9.4.1 Pipe Installation in Open Trenches

Payment shall be per lineal metre, to the nearest 0.1m, including pits and welds. Pipe installation shall include excavation, work around existing services, supplying, jointing, laying, haunching, provision of samples and testing, backfill placing and compaction. The supply of imported backfill is scheduled separately.

9.4.2 Pipe Installation by Pipebursting

Payment for pipe installation shall be per lineal metre, to the nearest 0.1m, including pits and jointing. Pipe installation shall include location of services, pipe bursting, pulling the pipe, haunching and backfilling in pits, including the supply of all materials, provision of samples and testing.
9.4.3 Pipe Installation by Slip Lining
Payment for pipe installation shall be per lineal metre, to the nearest 0.1m, including pits and jointing. Pipe installation shall include cleaning the host pipe and checking for clearances, pulling the pipe, haunching and backfilling in pits, including the supply of all materials, provision of samples and testing.

Special anchor blocks are scheduled separately.

9.4.4 Pipe Installation by Directional Drilling
Payment for pipe installation shall be per lineal metre, to the nearest 0.1m, including pits and jointing. Pipe installation shall include determining the alignment, drilling, haunching and backfilling in pits, including the supply of all materials, provision of samples and testing.

10.0 JUNCTIONS AND RISERS

10.1 Junctions
PVC junctions shall be formed with factory moulded junction fittings and in accordance with SD 363. PVC side junctions, inspection bends and ramped risers shall be metal haunched and surrounded. All junctions except for risers shall be fitted with their permanent seal before testing.

10.2 Risers
Risers shall be constructed where the main is greater than 1.8m below the finished road level, unless ordered otherwise by the Engineer.

This elevation may be altered to provide cover to the lateral at the road boundary as specified in clause 11.0 - Laterals. It may also be altered due to the presence of other services, the location of the water table, land levels and convenience of connection.

10.3 End Plugging
The ends of all junctions and riser pipes, if not brought into immediate use, shall be plugged in accordance with SD 363.

10.4 Polyethylene Junctions and Adaptors
Fittings shall be approved and factory made. Jointing shall be in accordance with clause 7.0 - Jointing. Junctions shall be constructed in accordance with SD 364. Cut edges shall be left smooth.

The Contractor shall horizontally over-excavate each junction hole by 200mm to allow the new line to be properly haunched.
The Contractor shall not backfill the trench until the Engineer has inspected the connections.

10.5 Measurement of Works and Basis of Payment

10.5.1 Junctions
Junctions shall be paid per item and shall include all costs over normal pipe installation, concrete surround, short pipes and end plugging. Junctions shall also include the replacement of up to 1.0 metre of each sewer lateral. Any subsequent length of renewal shall be paid under laterals.

The position and number of junctions specified is a guide only, and the actual position, number, type, and setting will be determined on site.

10.5.2 Risers
Payment shall be per metre, to the nearest 0.1m, measured from the face of the junction socket. Risers shall include the replacement of up to 1.0 metre of each sewer lateral. Any subsequent length of renewal shall be paid under laterals.

11.0 LATERALS

Laterals shall be constructed in accordance with clause 8.0 – Pipe Installation.

The existing main and laterals shall be kept in continuous operation until connected to the proposed piping.

The Contractor shall note that the exact location of some laterals is unknown.

The Contractor shall verify the reconnection to the new main of all live laterals. This may require the isolation of sections of the new main and flushing water down drain entries, gully traps or toilets to ensure each house is connected.

11.1 Laterals in Close Proximity to Trees

All adaptor joints in laterals shall be a minimum of 3 metres from the trunk of any tree.

Laterals that are located beneath the area occupied by the canopy of any tree or within 3 metres of its trunk shall be renewed using an approved trenchless method of installation.

11.2 Sewer Lateral Cover at Lot Boundary

The invert level of the sewer lateral at the lot boundary should be a minimum of 1100mm below the finished surface or at a depth sufficient to
adequately serve the whole lot. The cover over the barrel of the sewer lateral at the kerb should not be less than 800mm.

11.3 End Capping and Marking

Where laterals are not immediately connected to property drains, the blank end shall have a watertight end plug fitted. The blank end of the pipe shall be marked with a 100mm x 25mm stake, installed prior to backfilling from the pipe end vertically to 150mm below design finished level.

The timber stake will facilitate as-built measurements and location of the lateral for later connections.

11.4 Lateral/Mainline Sequence

Where the ground is soft and liable to settlement or a traffic hazard will result, the Contractor should lay laterals after the main pipeline trench has been backfilled and compacted.

11.5 Fluming of Disconnected Laterals

To eliminate uncontrolled sewerage discharge into any excavation or pit, the main and/or lateral in each excavation must be temporarily flumed within two hours of severing.

The Engineer shall approve the Contractor’s proposed method prior to use.

11.6 Laterals into Polyethylene Pipe

Laterals shall be constructed in accordance with clause 9.0 - Laterals.

The Contractor shall overtow the pipe by one lineal metre at one of the longer laterals. The excess pipe length shall be supplied to the Engineer for a visual inspection.

11.7 Connecting to Existing Laterals

PVC-u adaptors shall be installed over rubber rings onto earthenware laterals. The epoxy shall be screed off at a 45 degree angle.

New PVC-u laterals shall be connected to existing concrete laterals using stepped gibaults only. Gibaults shall be wrapped as specified in clause 7.1 – Mechanical Jointing.

11.8 Measurement of Works and Basis of Payment

Payment shall be per lineal metre, to the nearest 0.1m. Laterals shall be measured from the face of the junction socket. Laterals shall include all
those items in pipe installation under clause 8.0 – Pipe Installation, fluming and the verification that laterals are live and have been connected, fittings and restoration. The supply of imported backfill is scheduled separately.

11.8.1 Laterals Requiring Structural Maintenance
Existing laterals requiring structural maintenance shall be re-laid as ordered and payment will be made at the rate for installing laterals.

11.8.2 Laterals into Polyethylene Pipe
Laterals shall also include all those items in polyethylene pipe installation under clause 9.0 - Laterals.

12.0 STRUCTURES

Structures shall be positioned within 50mm horizontally of the location specified. All structures shall be watertight.

12.1 Reference Documents

A copy of NZS 3109 “Concrete construction” shall be kept on site. The below clause references shall extend and modify NZS 3109 as stated.

‘Recommended practice’, as stated in NZS 3109, clause 1.2.1, shall be adhered to unless specified below. The "Construction Reviewer", defined in NZS 3109, clause 2, shall mean the Engineer.

Reference should also be made to “Recommended Practice for Erection of Precast Concrete: 1985” (American Prestressed Concrete Institute).

12.2 Quality Assurance

12.2.1 Contract Quality Plan
The Contractor’s project quality system should encompass all aspects of the concrete construction, but be not necessarily limited to:

- Concrete strength testing (submit details in the Inspection and Test Schedule with tender) – see NZS 3109, clause 12.3.5.
- Inspection prior to placement of concrete (Concrete Pour Card Records).
- Reinforcement compliance records (e.g. Certificates of origin or Certification by a registered laboratory, reverse bend tests etc – see clause 12.3 - Reinforcement).
- Details of Concrete Supply to meet the requirements of NZS 3109, clause 12.6.5.
- Proposed concrete mix designs.
- Daily Concrete Batch Records (including water content and moisture content of aggregates).
- Tolerance checks of critical items (e.g. Checking cast-in weld plates).
- Monitoring of off-site precast manufacture.

The Contractor shall supply evidence of production quality standards to the Engineer in advance of construction in accordance with NZS 3109, clause 6.10.

Details of the proposed methods and frequency of such activities, and the reporting of these, shall be set out in the Contractor’s Contract Quality Plan.

12.2.2 Personnel
The Contractor’s Quality Controller shall complete and sign a written quality control checksheet for each off-site or on-site concrete pour, prior to any concrete being poured, to confirm that all work complies with the Contract documents. A typical checksheet is in Appendix 1.

The Contractor shall be represented on site by a competent leading hand (reinforcing), while steel is being placed. During pouring, the Contractor shall have appropriately skilled personnel on call to identify and correct any damaged or displaced reinforcing.

12.3 Reinforcement

All reinforcement shall be micro-alloy steel manufactured by Pacific Steel Limited. ‘Reidbars’ shall be supplied by Reid Engineering Systems Limited.

The Contractor shall prepare reinforcement schedules from the contract drawings. Reinforcing bar shall be notated on the drawings as follows, unless noted otherwise:
R – Plain Grade 300;
D – Deformed Grade 300E;
RH – Plain Grade 500E;
DH – Deformed Grade 500E;
RB – Reid Bar Grade 500E.

Further to NZS 3109, clause 3.3.4, bending of reinforcement shall conform to the minimum bend radii given in NZS 3101. Any reinforcement that does not comply shall be rejected and replaced.

Further to NZS 3109, clause 3.3.8, re-bending of Grade 500E reinforcement shall not be allowed. Any reinforcement that has been re-bent shall be rejected and replaced.
Further to NZS 3109, clause 3.4, steel reinforcement shall be stored on supports clear of the ground and shall be protected from sea spray, on delivery to site.

Further to NZS 3109, clause 3.5.1, where top steel in slabs is supported from bottom steel, a plastic spacer shall be placed beneath the bottom steel immediately under the top steel support.

Further to NZS 3109, clause 3.9, under no circumstances shall reinforcement be displaced from the positions shown on the drawings for the purpose of accommodating conduits or service pipes etc. of any description, without the written permission of, and to the details specified by, the Engineer.

Further to NZS 3109, clause 3.7.1, lapping bars necessitates the Engineer’s approval.

Splices in adjacent bars shall be staggered by at least 600mm. Bars with kinks or bends not shown on the drawings shall not be used.

Further to NZS 3109, clause 3.7.2, welding of reinforcement necessitates the Engineer’s approval. No site welding shall be permitted under any circumstances.

If permitted, welding shall comply with AS/NZS 1554.3 “Structural steel welding - Welding of reinforcing steel”. Grade 500 reinforcement shall not be welded without the development of a specific shop welding procedure.

The Engineer shall approve welders and shall inspect welds, where specified.

### 12.4 Formwork

*All concrete exposed in the finished structure, and in particular that which is in frequently used public spaces, shall have the formwork and spacer layout approved by the Engineer prior to construction commencing.*

Further to NZS 3109, clause 5.1.1, all concrete shall be placed in formwork unless specified or approved otherwise.

Formwork shall be inspected and levels checked immediately preceding the placing of reinforcement and any bulging, warping or lack of fit shall be remedied. The formwork for each section of concrete placement shall be completely constructed before concreting of that section is commenced.
Steel formwork shall have all joints welded and ground smooth and flush. All internal corners shall be formed by folding the steel, not by butting.

Further to NZS 3109, clause 5.1.2, concrete work that is misshapen or in any other way defective due to the inadequacy of the formwork, shall be rejected, removed and replaced or the defect remedied as directed by the Engineer, at the Contractor’s cost.

Further to NZS 3109, clause 5.1.4, all insertions shall have a slight bevel to ensure easy removal without damage to the concrete.

Further to NZS 3109, clause 5.1.6, before the reinforcement is placed, the interior surfaces of forms shall be treated with a release agent to prevent adhesion of mortar. Release agents shall be of a non-staining type applied in a thin film.

12.4.1 Construction Requiring Support From Other Permanent Works

Further to NZS 3109, clause 5.1.8, at least ten Working Days prior to the commencement of construction requiring support, the Contractor shall supply to the Engineer the following information.

- Details of scheduled removal of props or loading of support elements, including age of various levels of construction at critical stages.
- Calculations or a Producer Statement from a Chartered Engineer, demonstrating that the requirements of this clause are satisfied.
- Details of any concrete strength testing, additional to clause 12.17 – Compliance Testing, to demonstrate that adequate strength is obtained prior to removal of props.

In providing support to construction from a previously constructed structure, the Contractor shall plan the removal of propping such that stresses and deflections are not excessive as follows:

Construction Loads

The construction loads imposed on a structure of age 28 days or more shall be such that the strength requirements do not exceed those induced by the design loading, unless it is demonstrated by calculation that the strength requirements are within the capacity of the supporting structure.

Where the structure is less than 28 days old, the allowable loads shall be appropriately reduced.

The Contractor is warned that leaving props in place may in some cases lead to an unacceptable accumulation of stresses in lower construction.
Deflections
Where construction loads on a structure are such that strength requirements are greater than those due to the design loading, or where a structure shall be loaded at an age less than 28 days, the Contractor shall demonstrate that calculated final deflections (following removal of construction loads and application of design loads) are either less than the calculated deflections which would be caused by the application of the design loading, or within acceptable limits as defined by the Engineer. Such calculations shall take into account, where appropriate, non-recoverable deflections due to creep of young concrete.

Further to NZS 3109, clause 5.3.2, the straightness over a 3.0m straightedge shall not disclose out-of-plane exceeding 1mm.

Notwithstanding the tolerances specified, no tolerances shall be permitted to accumulate to such an extent that the accurate placing of precast units to meet the tolerances shown in the Drawings, fixings, equipment, reinforcement, etc., is jeopardised.

Where an error requires correction between one bay and the next or between one level and the next, the Engineer shall approve such corrections in advance.

Further to NZS 3109, clause 5.4, the following minimum stripping times shall apply for the following classes of work:

<table>
<thead>
<tr>
<th>Class of Work</th>
<th>Portland Cement</th>
<th>Rapid Hardening Portland Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal of formwork from walls and risers.</td>
<td>48 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td>Removal of formwork from haunching, junctions, etc.</td>
<td>24 hours</td>
<td>18 hours</td>
</tr>
<tr>
<td>Removal of props from manhole and flush tank slabs, culverts, etc.</td>
<td>21 days</td>
<td>7 days</td>
</tr>
</tbody>
</table>

All formwork shall be removed before backfilling. All external angles in exposed members shall be protected against injury after stripping.

Once the formwork has been stripped all tie holes, honeycombing and excessive blowholes shall be filled and sufficiently compacted with mortar composed of one part of cement to two parts of clean plastering sand. Care shall be taken to apply sufficient mortar to fill the voids, as it is not intended that the whole surface be coated. After the mortar has dried, but not set, the mortared surfaces and all abrupt changes, as defined in NZS 3114 Figure 1, shall be rubbed with a coarse carborundum stone to produce a smooth surface free from honeycombing, excessive blowholes and sharp abrupt changes.
12.5 Precast Concrete Shop Drawings

The Contractor shall produce and provide, if specified, fully detailed shop drawings for all precast concrete. These drawings shall be sufficient to enable fabrication of the structures to the dimensions, shapes and standards specified. The Engineer shall receive the shop drawings at least 5 working days before fabrication.

The Contractor shall ensure that:

- shop drawings are co-ordinated with the requirements of all other trades and other trade’s shop details, in particular electrical, plumbing, drainage and steelwork.
- all necessary site measurement and checking has been undertaken.
- the shop drawings are co-ordinated with all Contract requirements.

The Contractor shall advise the Engineer of any errors, omissions or conflicts found in the Drawings during the shop drawing preparation.

The Engineer shall review the shop drawings for design concept and general arrangement only. Dimensional accuracy remains the Contractor’s responsibility. Drawings shall be provided to the Engineer 10 working days prior to manufacture of the precast units.

12.6 Embedded Items

Further to NZS 3109, clause 5.5, the Contractor shall check the requirements of other trades and shall be wholly responsible for the accuracy of locating all such items. All embedded items shall be accurately set and supported in place until the concrete has set.

Where pipes, castings, or conduits pass through a wall or floor, the Contractor shall place such pipes or castings in the form before placing the concrete. The Contractor may alternatively build boxes in the forms, where specified or as approved by the Engineer.

To withstand water pressure and ensure watertightness around openings, the boxes or cores shall be provided with continuous keyways and shall have a slight flare to facilitate concreting in walls and the escape of air entrained during concreting. Where possible, boxed holes shall be orientated with an apex over the pipe. The face between the boxed opening and void to be concreted shall be treated as a cold joint.

The pipes, castings or conduits shall be concreted in place under a concrete head of at least 100mm. The concrete shall be worked into place to completely fill the space between the pipes, castings or conduits and the sides of the openings to obtain the same watertightness as through the wall itself. Pipes less than 75mm diameter in cored holes shall be fixed in place as specified.
Where the floor of the structure is poured separately, the concrete in the vicinity of the embedded pipe shall be kept sufficiently low to ensure the gap between pipe and floor is a minimum of 50mm when the pipe is laid.

In water retaining structures the minimum cover to embedded tie bolts shall be 40mm. Tie boltholes shall be filled with dry pack mortar or an approved equivalent, within two days of the removal of formwork.

12.6.1 Knock Out Panels
The Contractor shall make provision for future pipelines by forming 80mm thick square panels at the required levels, where specified or directed by the Engineer. The panels shall be formed by boxing out 150mm thick recesses on the outer side of the wall. Unused knock out panels shall be filled with concrete to the structure’s full wall thickness.

12.7 Construction Joints

Further to NZS 3109, clause 5.6.1, where construction joints in slabs are not detailed, the Contractor shall ascertain the requirements of the Engineer before commencing. Walls may be poured in lifts exceeding 3000mm provided that the Contractor can demonstrate to the Engineer his ability to do so properly and consistently.

Further to NZS 3109, clause 5.6.2.3, the Engineer reserves the right to nominate the method of repair, if edges at construction joints are damaged.

Further to NZS 3109, clause 5.6.3, all construction joints shall be prepared and constructed to meet the requirements for 'Type B' construction joints, unless specified otherwise.

The Contractor shall take special care at all construction joints to ensure that no joint will be a source of future weakness or leakage and that the specified surface finish is obtained either side of the joint. Approved water stops shall be used where specified or required by the Engineer. This is likely to be where there may be a head of water across the joint.

In general, construction joints shall be perpendicular to the principal lines of stress. Construction joints across embedded pipes and lower than half pipe level should be avoided as a “V” is created between the concrete and pipe and it is difficult to get a proper seal in this section of the joint when the next lift is poured.

Vertical construction joints shall not be permitted except where unavoidable and approved. Horizontal joints shall be evenly spaced, horizontal and continuous round any structure unless otherwise specified.
The joint surface shall be treated within 24 hours of casting. Concrete shall not be placed against a construction joint face within 24 hours of an earlier placement.

The Engineer shall approve any alternative joint surface preparation.

12.8 Supply of Concrete

Further to NZS 3109, clause 6.1, no calcium chloride accelerator or similar chloride-containing admixture shall be added to any mix.

Further to NZS 3109, clause 6.2, all concrete shall be Normal (N), with sufficient cement quantity to ensure satisfactory finish and durability. The nominal maximum aggregate size shall be 19mm. The water content shall not exceed 170 kg/m³.

Where specified, waterproof concrete shall contain XYPEX Admix C-1000 NF waterproofing admixture in accordance with the manufacturer’s specifications.

If concrete does not comply with the slump specification on site, the Contractor may add superplasticiser to bring the concrete up to the specified slump. In all cases, the mix shall have been designed to be tolerant to this on-site modification. Full records of the addition of superplasticiser on site shall be kept on the delivery docket and on the plant batching records, including minimum mixing time after the addition of the superplasticiser.

Further to NZS 3109, clause 6.3, the specified strengths are shown in the Drawings, but generally 10 MPa for site concrete, 50 MPa for piles, 40 MPa for foundation elements, 30 MPa for precast and in-situ walls and floor slabs and 20 MPa for footpaths.

12.9 Concrete Placing, Finishing and Curing

The Engineer shall be notified and given a reasonable opportunity (a minimum of 24 hours) to inspect formwork, reinforcement and construction joints before pouring commences.

Concrete that has partially hardened or has been contaminated by foreign materials shall not be deposited in the works. Retempered concrete shall not be used in the works.

Further to NZS 3109, clause 7.1, concrete shall not be pumped without the Engineer’s prior approval. If approval is given, the concrete mix shall not be adjusted but the specified slump may be altered with the addition of superplasticisers. The Engineer requires notification in writing at least five working days before placement for approval.
Further to NZS 3109, clause 7.2, concrete shall not be placed when the outdoor shade temperature exceeds 25°C and no concrete shall be placed in water without the Engineer’s approval. If approved, the mix shall be adjusted and the work carried out as required by the Engineer.

Concrete shall not be exposed to rain or sea spray during mixing, transport or placing or until it has set.

Further to NZS 3109, clause 7.4, concrete shall be deposited as near as practicable to its final position. It shall not be dropped from a height in excess of 2m except with the prior permission of the Engineer, nor shall it be dumped away from its final position and worked along the forms.

Except at permitted construction joints, concrete in each section of the work shall be placed in a continuous operation such that new concrete is constantly being placed against unset concrete to produce a monolithic mass.

All barrow runs, chute runs, pipelines, walkways and any other means of conveying concrete shall be adequately supported by independent means directly from the formwork and in no case shall the means of conveying the concrete be supported from or allowed to displace the reinforcement.

The Contractor shall organise the delivery of concrete in such quantities as can be effectively handled by the labour and equipment available. The Engineer may at his discretion order the Contractor to provide additional equipment or men to assist in placing concrete and/or alter the method of placing.

Further to NZS 3109, clause 7.7 and unless specified otherwise, the required finish shall be:

- F5 for precast units and all other visible concrete, except as below
- F4 for in-situ concrete where surfaces are not visible, except as below
- F3 for interiors of manholes, flush tanks and culverts
- U3 for slabs, except as below
- U5 for footpaths and bridge deck surfaces
- U1 for site concrete.

Set concrete shall not be cut, hacked or cored unless specific approval is obtained from the Engineer.

For concrete at all surfaces (except floors) which will be visible on completion of the works, the minimum cement content shall be 350 kg/m³ mixed concrete and the maximum water cement ratio shall be 0.40. The Contractor shall allow for supplying a greater cement content than this should it be necessary to achieve the finish specified.
Further to NZS 3109, clause 7.8, the Contractor shall take adequate steps to prevent surface evaporation of mix water, without increasing the water content of the concrete.

These measures may include the provision of windbreaks or the application of a fine mist spray during concreting operations or any other measure approved by the Engineer.

Traffic shall be kept off all structures until they have achieved the specified strength.

Care shall be taken that no shock or vibration reaches concrete after setting until it is at least 3 days old, and that any starters projecting from green concrete are not shaken or disturbed. Concrete in which the reinforcement has been displaced shall be declared defective and shall be demolished.

Further to NZS 3109, clause 7.8.2, all flat slab work shall be wet cured by flooding or continually sprinkling for 24 hours after concrete finishing. After 24 hours, the surface shall be dried by squeegee for the immediate application of a 90% efficiency-curing compound, in accordance with the manufacturer’s instructions. The Contractor shall ensure the curing compound proposed is compatible with the subsequent floor covering or paint finish.

Further to NZS 3109, clause 7.8.3, all vertical work, such as columns and walls, shall be cured by either leaving enclosed with formwork or tightly wrapping with polythene for at least 7 days after pouring.

12.9.1 Precast Concrete
Each unit shall be cast in one continuous pour, and shall be properly cured as soon as practicable after casting. Curing shall be by steam, wrapping in polythene or other method approved by the Engineer.

Finished units shall be crack free.

12.9.2 Slabs
Slab surfaces shall be finished to a hard, smooth, polished finish which does not vary more than 5mm from a 3 metre straight edge and is free from trowelling ridges or other irregularities.

The slab shall be screeded off to the lines and grades shown on the drawings with a vibrating screed, followed at intervals by power float compaction. Extreme care shall be taken to ensure that vertical starter rods are not disturbed during power floating.

Tradesmen expert and experienced in this type of work shall carry out power floating, as the time and intervals for the execution of the work requires close judgement. The Contractor
shall arrange the placement of slabs to allow adequate time to achieve this requirement.

An excess of fines shall not be worked to the surface, and no hand trowelling in of dry cement, fines or cement plaster will be permitted.

Where required to make good levels, an approved floor levelling compound shall be used.

Joints for slabs on grade shall be saw-cut within 24 hours of pouring to the specified pattern.

The Contractor shall protect the slab from damage and shall demonstrate that the slab has sufficient strength to resist applied loads.

12.10 Precast Concrete Handling, Transportation and Erection

Units shall be handled, transported and erected so that they are not damaged or soiled. The Engineer shall reject any damaged unit.

Units shall be lifted by appropriate lifting equipment, using specifically designed lifting inserts only. The Contractor shall be responsible for the design, provision and subsequent removal and making-good of any lifting inserts. The Contractor shall also engage a Chartered Engineer to design any additional reinforcement required for the handling or cartage of the precast concrete and of lifting inserts.

Where possible, lifting inserts and temporary lateral supports shall be located on faces/sections of the panels that are not visible.

The Contractor shall notify the Engineer prior to the removal of temporary lateral connections and props.

An approved tradesman shall carry out mortar packing between units and grouting of ducts. Both the mortar and grout used shall be Conbextra GP or approved equivalent, used in accordance with the manufacturer’s instructions.

The Contractor shall take all reasonable steps to ensure the colour of the surface finish achieved on the cast-in-situ joints, mortar packing and grouting matches that of the precast units.

12.10.1 Tolerances

The Contractor shall advise the Engineer, before construction begins, if unable to meet the tolerances inherent in the specification. The Contractor should be aware that the total tolerance indicated by a detail may require the co-operation of
several trades (e.g. Precaster for fixings in precast work, Metalworker for brackets and the like, and Concreter for cast-in-situ fixings).

12.11 Manholes

Standard manholes shall be in accordance with SD 302 or SD 303. Narrow and drop manholes shall be in accordance with SD 304 and SD 305.

*The neck of a new standard or flush manhole shall not be deeper than 450mm.*

12.11.1 Special Construction Joint

*The Contractor shall place a layer of malthoid between the top of manhole wall and the cast in-situ slab to form a special construction joint to allow for the future alteration of the level of the manhole top. For all precast manholes, a riser with a minimum depth of 100mm shall be used under the slab.*

12.11.2 Manhole Benching and Channelling

*Manhole benching and channelling etc, shall be in accordance with SD 302, SD 303, SD 304 and SD 305. Manhole benching and channelling shall be constructed with 25 MPa concrete. All ironwork shall be in accordance with SD 301. For pipelines exceeding 750mm in diameter, toe-holds shall be provided in the channelling.*

12.11.3 Joints Between Precast Risers

*The joint between adjacent precast risers shall not exceed 5mm at any point. Joints shall be positioned as high in the structure as possible. An approved sealing strip shall be used in all joints.*

12.11.4 Precast Manhole Tops

*Precast manhole tops shall be in accordance with SD 302, SD 303 and SD 304. The tops shall be approved, unless permission is given by the Engineer to precast on site.*

12.11.5 New Manhole on an Existing Pipeline

*Where a new manhole is to be built over an existing pipeline, the pipeline and any concrete foundation or haunching shall be left intact. The area under this shall be excavated out to a minimum depth of 225mm and the new manhole base poured completely under this to the outside dimension of the manhole in one operation. Care shall be taken to ensure that the new concrete foundation is grouted and bonded to the existing concrete. The existing pipeline and any surplus haunching shall not be cut away until after the new branch pipeline is inspected and passed.*
12.11.6 **New Pipe Invert in Existing Manhole**  
Where the manhole invert is being adjusted to a higher pipe level, the manhole shall be filled with flowable fill or concrete to a level 50 mm below the new invert. Where the new invert is less than 200mm above the old invert, the benching shall be broken out to 50mm below the new invert and for 100mm each side of the new pipe diameter. Re-benching shall be in accordance with clause 12.11.2.

12.12 **Flush Tanks and Manholes**

12.12.1 **Flush Tanks**  
*Flush tanks shall be located where specified and constructed and equipped in accordance with SD 311.*

12.12.2 **Flush Manholes**  
*Flush manholes shall be constructed in accordance with SD 302 and SD 312. The 25mm galvanised wrought iron supply pipe shall be fitted to a star socket cast into the precast wall at the time of manufacture.*

12.13 **Frames and Lids**

Frames shall be seated evenly on a bed of cement sand mortar. The mortar thickness shall not be less than 10mm or more than 25mm.

The frames shall be fixed into the rebates with asphalitic concrete, cement sand mortar or concrete with a 6mm maximum aggregate size. Accelerating admixtures may be used.

Where asphalitic concrete is used the surfaces of the frame and concrete rebate shall be primed with bituminous emulsion and the asphalitic concrete placed and thoroughly rammed in 300mm layers.

12.14 **Air Gap Separators**

*Air gap separators shall be installed where specified and in accordance with SD 313.*

The Engineer shall verify the operation of the air gap separator and the watertightness of the plug in the flush tank or flush manhole.

12.15 **Other Minor Structures**

Other structures shall include sumps, headwalls, beams, inspection chambers, house drain sumps and house drain inspection boxes. These structures shall be constructed in accordance with SD 321, SD 322, SD 324, SD 325, SD 327, SD 328, SD 371, SD 372, SD 375, SD 376 and SD 378.
12.16 Concrete Repair

The Contractor shall advise the Engineer of any defective concrete. No repairs shall be undertaken without the approval of the Engineer. Provide a non-conformance report as detailed in IDS, clause 3.7 – Non-conformance and quality improvement.

The Contractor shall provide a method statement prior to commencing any repairs to concrete. The method statement shall include appropriate details of the extent of repair work proposed, the extent and type of preparation, type of repair materials and method of application, protection and curing methods, standard of finish which will be achieved and other relevant details. The Contractor shall allow the Engineer reasonable time to review, comment, accept or reject the proposed repair method before commencing work. Such rejection may require the defective concrete to be removed and replaced.

Completed repair works shall comply with the specification or as otherwise accepted by the Engineer, which shall include a finish consistent with the surrounding areas. Special attention may be required to achieve acceptable long-term surface finish match (e.g. colour, texture, etc) to visible areas.

12.17 Compliance Testing

Further to NZS 3109, clause 9, all concrete shall have a slump of 80mm with a tolerance of +0mm - 20mm, unless specified otherwise. The Contractor shall carry out concrete compression tests and slump tests where ordered by the Engineer.

12.18 Measurement of Works and Basis of Payment

12.18.1 Concrete Construction
Concrete construction shall be included in the rate for the structure being constructed. This rate shall include all formwork, detailed inserts and fittings, reinforcing, joints, mortaring and materials. It shall also allow for any details specifically for associated trade work.

All specified testing of materials prior to, during and after placement shall be included in the rate for concrete construction. Unspecified complying tests shall be paid as a variation.

12.18.2 Manholes
Manholes shall include excavation and disposal of spoil, metal foundations, supply and installation or construction of the structure, all benching, jointing, ironwork including frames and lids, restoration of unused knockout panels and backfilling.
Where a manhole location is altered and the depth of the altered manhole is within 300mm of the depth of a scheduled manhole it shall be paid at that rate. If outside this limit a variation will be ordered.

New pipe invert in existing manhole shall include breaking out and disposal, supply and placement of filling, benching, jointing, adjustments to ironwork.

12.18.3 Flush Tanks and Manholes
Flush tanks and manholes shall include excavation and disposal of spoil, metal foundations, supply and installation or construction of the structure, all benching, jointing, iron work including frames and lids and backfilling.

12.18.4 Air Gap Separators
Air gap separators shall include excavation and disposal of spoil, foundations, supply and installation or construction of the fitting, all jointing, plumbing and backfilling.

Where the air gap separator is installed as part of a Council contract, the Council shall supply the air gap separator parts shown on SD 313. The Contractor shall supply all benching, jointing, ironwork, restoration of unused knockout panels and backfilling.

For beams, the cost of pipelaying shall be included in the rate for Pipelaying unless otherwise specified.

House drain inspection boxes do not include the saddle in or kerb entry adaptor.

12.18.5 Other Minor Structures
Other structures shall include excavation and disposal of spoil, metal foundations, supply and installation or construction or the structure, all benching, jointing, ironwork, restoration of unused knockout panels and backfilling.

The rate for sumps includes maintaining a clear sump well to at least 100mm below the invert of the lowest pipe over the Defects Liability period and to clean the sump well completely at the end of the Defects Liability period.

For beams, the cost of pipelaying shall be included in the rate for Pipelaying unless otherwise specified.

House drain inspection boxes do not include the saddle in or kerb entry adaptor.
12.18.6 **Concrete Repair**

The Contractor shall not be entitled to additional payment for the repair of defective concrete construction.

13.0 **CONNECTIONS AND ALTERATIONS TO EXISTING SYSTEM**

Existing flows in sewer pipes shall not be pumped into any stormwater system or onto the existing ground.

The Contractor shall ensure that no dirt or debris enters the existing system.

Where pipes are to be connected to existing pipes or structures the Contractor shall expose the existing system well ahead of the work so that levels and positions can be checked.

If entry openings are required in a precast or existing manhole and no knock out panels have been left, the openings shall be made using a diamond-cutting blade or hole saw. Under no circumstances shall a hammer or impact tool be used.

13.1 **Measurement of Works and Basis of Payment**

Connections and alterations shall be included in the rate for pipe installation, unless scheduled separately. This rate shall include exposing the existing system ahead of the work, any necessary dewatering and pumping or fluming of the existing pipe flow.

14.0 **PERFORMANCE TESTING**

The Contractor shall perform tests as detailed below on all newly installed pipework. The Engineer shall be present at all site tests and shall be given 24 hours notice.

14.1 **Equipment**

Gauges used shall have a maximum reading of no more than twice the test pressure. Gauges and meters shall be calibrated at 12-month intervals.

The testing apparatus shall be equipped with a pressure relief device to prevent loading the test section with the full capacity of the compressor.

The Contractor shall arrange water supply for and the removal of water from pipelines or structures after each test.

14.2 **Gravity Pipelines**

All gravity pipelines up to and including 600mm internal diameter, irrespective of the material, shall be subjected to a hydrostatic or air test.
and a visual inspection. Pipes over 600mm diameter shall not be subject to a hydrostatic or air test but shall be visually checked for ring location, potential leakage and defects before final haunching of the pipeline or backfilling of the trench will be permitted. Complete the Gravity Pipe Test Checksheets in Appendix XIV of IDS: Part 3 – Quality Assurance, as modified by the Engineer.

If the pipeline fails the air test, the cause of failure shall be detected by audible or visual means and rectified and the test repeated. If no defect can be detected the Contractor may either:

- wet the pipeline internally and/or externally and repeat the air test.
- carry out a hydrostatic test.

If the Engineer has reason to suspect that damage has occurred to the pipeline during or after backfilling a further test between manholes, sumps, etc, will be required.

14.2.1 Structures
The Engineer may request a hydrostatic test be applied to any structure. When applied to any flush manhole, flush tank or sump, the head shall be fixed at ground level.

14.2.2 Testing Junctions
Testing junctions shall be installed where ordered. After testing, all testing junctions shall be plugged and concrete or ceramic pipes shall be surrounded with 100mm minimum thickness of concrete.

14.2.3 Visual Inspection
Each pipe and joint shall be visually checked for leakage and defects before any concrete haunching of the pipeline or backfilling of the trench will be permitted.

Where pipes are to be metal haunched only sufficient foundation and haunching metal shall be placed prior to testing to ensure adequate stability of the pipes. Metal shall be placed to allow a full visual inspection of all joints and the maximum possible inspection of the barrel.

14.2.4 Hydrostatic Test
The level of water in the testing equipment shall not drop over the period of the test under the specified pressure. The rate of drop in water level in the testing equipment will not be accepted as the only measure of watertightness of the line. No part of the pipeline shall be subjected to a head of water greater than 6 metres, for safety reasons.

The pipe shall be tested with a head of water at the centre line of the upper end of the pipe equal to 3 metres, or the depth from
ground surface to centre line of the pipe at the upper end, whichever is greater.

The test pressure shall be maintained for a minimum period of 5 mins or the time required to enable a full visual inspection of the pipeline under test where it is greater than 5 mins.

14.2.5 Air Test

The pressure in the test section shall not drop more than 200mm (2 kPa) over the period of the test, as set out in the table below.

<table>
<thead>
<tr>
<th>Pipe Dia (mm)</th>
<th>Length of test section (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>≤150</td>
<td>2:00</td>
</tr>
<tr>
<td>200</td>
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<tr>
<td>300</td>
<td>2:00</td>
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<tr>
<td>375</td>
<td>2:00</td>
</tr>
</tbody>
</table>

Table of Air Test Periods for Reinforced Concrete and Ceramic Pipes (min:secs)

For safety reasons, plugs must be well braced into position as the failure of a plug could result in serious injury.

Increase the pressure in the test section slowly to just over 3m water head. (3m water = 30 kPa). Maintain the pressure between 3000 and 3100mm head for a minimum of two minutes.

14.2.6 CCTV Inspection

All gravity wastewater pipelines of 150mm diameter and above shall pass a CCTV inspection, carried out after completion of all construction works. This shall only apply to pipes to be vested in Council ownership, which cover one manhole length or greater.

Stormwater pipelines of 225mm diameter and above as listed below shall pass a CCTV inspection, carried out after completion of all construction works:

- Connected to a manhole or inspection chamber;
- Connected to an outfall structure;
- Between sumps and located outside the legal road;
- Between headwalls and located outside the legal road.

This shall only apply to pipes to be vested in Council ownership.

A professional operator shall carry out the CCTV inspection using a pan and tilt camera, in accordance with CCTV for
Christchurch City Council Earthquake Recovery and the technical specification of the New Zealand Pipe Inspection Manual. CCTV for Christchurch City Council Earthquake Recovery is the “particular specification” in accordance with section 5 of the New Zealand Pipe Inspection Manual.

The operator shall pan around every joint and weld and check every lateral connection and defect.

The video footage in DVD format, and the accompanying CCTV log sheets for each sewer length (as per the template in the NZ Pipe Inspection Manual), showing the features and condition of all inspected manhole lengths, shall be provided to the Council as part of the as-built record submitted through the Contract Quality Plan. Video footage supplied without log sheets will not be accepted.

All pipelines shall be free of debris and cleaned with a high pressure cleaner within 24 hours prior to inspection. Any debris shall be removed from the pipeline, not flushed further down the system. Inspections of dry pipelines are not acceptable.

A pipeline will fail its inspection if:

- The pipe has visible dips or ponding of water.
- The pipe has visible defects, such as open or displaced joints, improperly removed weld beads, defective or protruding laterals, cracked barrels or similar defects.
- There is evidence of infiltration at joints or laterals.

14.3 Pressure Pipelines

Pressure pipelines shall be water tested in-situ, to the specified in-ground pressures, when fully haunched and backfilled. Complete the Pressure Pipe Test Checksheets in Appendices XV and XVI of IDS: Part 3 – Quality Assurance, as modified by the Engineer.

The Contractor shall pressure test the whole pipeline. It is recommended that testing also be carried out in shorter lengths. The Contractor may carry out intermediate air tests to a maximum of 98kPa. These tests will not be accepted as compliance tests.

Test points in concrete pressure lines may comprise either three special short pipes, the central pipe being connected to the outer two by gibault type joints or alternatively a standard length pipe may be cut into three sections using a stonemason saw, the cut surfaces being protected with an epoxy coating applied strictly in accordance with the manufacturer’s instructions.
14.3.1 **Concrete Pipe**

Pipes shall be left full of water for a minimum of 24 hours before the tests, to allow them to become fully hydrated.

Increase the pressure. The rate of pressure increase or decrease shall not exceed 70 kPa per minute and no pressure surges will be permitted.

**Working Pressure Test**
Increase the pressure to the specified working pressure. The pressure shall be maintained for a period of three hours and the pipe shall show no water loss.

**Maximum Operating Pressure Test**
Increase the pressure to the specified maximum operating pressure. The pressure shall be maintained for a period of five minutes and the water loss from the pipe (measured in millilitres per hour) shall not exceed 0.3 x length (metres) x diameter (millimetres).

The loss from the line shall be determined by measuring, with an accurate water meter, the amount of water required to hold the pipe at test pressure.

14.3.2 **Polyethylene Pipe up to DN 315**

A pressure test shall be carried out in accordance with clause 6.3.4.4 of AS/NZS 2566.2 “Buried flexible pipelines – Installation”. A graphical plot of the pressure test shall be supplied to the Engineer with the test readings.

The equation to determine the maximum allowable air volume in the pipeline shall be:

\[
\Delta V_{\text{max, allowable}} = 1.2 V \Delta P \left\{ \frac{1}{E_w} + \frac{D}{e E_R} \right\}
\]

Where:
1.2 = air allowance
V = pipe volume (litres)
\(\Delta P\) = measured drop (kPa)
\(E_w\) = bulk modulus of water (kPa)
D = pipe internal diameter (m)
e = pipe wall thickness (m)
\(E_R\) = pipe material modulus (kPa)

If \(\Delta V > \Delta V_{\text{max, allowable}}\) the test has failed as there is too much air in the line. The cause shall be located and rectified. The preliminary phase shall be repeated. If \(\Delta V < \Delta V_{\text{max, allowable}}\) proceed to the main test phase.
The clause M7.5 (c) equation and (d) in AS/NZS 2566.2 are incorrect.

The graphical plot shall be generated by a calibrated data logger and shall clearly show the pressure fluctuations, the rebound and the decay curve.

Swab the pipeline to remove air before carrying out the pressure test.

The test pressure shall not exceed 1.25 times the rated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.

14.3.3 Polyethylene Pipe over DN 315
A pressure test shall be carried out in accordance with clause 6.3.4.2 of AS/NZS 2566.2. A graphical plot of the pressure test shall be supplied to the Engineer with the test readings. Swab the pipeline to remove air before carrying out the pressure test.

14.3.4 Self Tapping Electrofusion Saddles
A pressure test shall be carried out in accordance with Appendix M Method 8 of AS/NZS 2566.2.

14.3.5 PVC, Ductile Iron, Glass Reinforced Plastic Pipe
A pressure test shall be carried out in accordance with clause 6.3.4.1 of AS/NZS 2566.2.

The test pressure shall not exceed 1.25 times the rated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.

14.4 Vacuum Sewer Tests

Vacuum testing of all vacuum mains, including vacuum service laterals, shall be undertaken in accordance with WSA-06 Vacuum Sewerage Code of Australia, Section 41.4. The ‘Complete Sewer’ vacuum test as specified in WSA-06 Section 41.4.4 may be applied to complete zones (mains) individually, or to the entire system.

Vacuum interface valves shall be removed and the pipe connection plugged, or alternatively if provided the isolation valve in each chamber shall be closed. Vacuum testing must be carried out against interface valves as the valves may not seal perfectly during the test.

The vacuum pressure test record chart/plot shall be provided with the Compliance Requirements Checksheet.
14.5 Polyethylene Pipe Weld Tests

Welds shall be inspected in the field and assessed in accordance with the requirements of AS/NZS 2033 “Installation of polyethylene pipe systems”.

Testing shall be carried out in an approved laboratory.

Additional test joints shall be made and tested if there is any change to machine, operator, pipe supplier or PE material.

14.5.1 Pre-construction Joint Testing – Electrofusion

For pipes with nominal diameters 90mm and larger, joints shall be tested in accordance with ISO 13954 Peel decohesion test. For pipe diameters smaller than 90mm, joints shall be tested in accordance with ISO 13955 Crushing decohesion test.

The Contractor shall complete two joints for each pipe diameter and material, using the machine and operator named in the Contract Quality Plan.

Results shall include a commentary on and photos of the failure mechanism, including: peel depth and quality, ovality, gaps and insertion into the coupler, joint alignment, melt flow into cavity. Failed joint samples shall be made available to the Engineer if requested.

The relevant jointing log sheet and a graphical plot of the load versus extension shall be supplied for each test. Ductility shall be evident through the plot showing a rounded top and an extended sloping recession leg. The load extension graph may be used by the Engineer in assessing the results of the test.

14.5.2 Pre-construction Joint Testing – Butt Fusion

One joint and one section of virgin pipe, for each pipe diameter and material type supplied for the project, shall be tested in accordance with ISO 13953 “Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint”.

Results shall include a commentary on the failure mechanism. Failed joint samples shall be made available to the Engineer if requested.

The Contractor shall complete the joint using the machine and operator named in the Contract Quality Plan, to demonstrate that the methodology and fusion parameters proposed will produce acceptable fusion joints. The weld bead shall comply with clause 7.4.7 – Bead Profile. The relevant jointing log sheet and a graphical plot of the load versus extension shall be supplied for each test. Ductility shall be evident through the plot showing a
rounded top and an extended sloping recession leg. The load-extension graph may be used by the Engineer in assessing the results of the test.

The joint must fail at a stress which is greater than 0.9 of the virgin pipe material. Test pieces with a wall thickness < 20 mm shall rupture in a ductile manner.

The cut-out joints shall be of sufficient length to make test pieces that comply with the requirements of ISO 13953 for Type A test specimens. Where the pipe wall thickness > 25 mm, a modified Type A test piece shall be produced by machining a similar amount from each side of the test piece to reduce the wall thickness to 22 mm ±2 mm.

If satisfactory tensile test results cannot be obtained and appropriate ductility of the rupture surface is not illustrated by the load-extension graph and associated photographs, the Contractor shall provide the Engineer with details of the proposed actions to determine the cause of the problem, through the provision of a Non-Conformance Report. No further pipe installation shall take place until the corrective action is accepted.

14.5.3 Joint Testing During Construction – Electrofusion
One site constructed joint shall be tested for each 20 joints constructed for each differing diameter or material, in accordance with clause 14.4 – Polyethylene Pipe Weld Tests. Where the length is between 100m and 50m, one joint shall be tested. Lengths less than 50m shall require only pre-construction testing. The Engineer shall select the joints for testing.

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in clause 14.4.5 – Joint test failures.

14.5.4 Joint Testing During Construction – Butt Fusion
One joint per pipeline for every 20 joints constructed shall be tested in accordance with clause 14.4 – Polyethylene Pipe Weld Tests.

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in clause 14.4.5 – Joint test failures.

14.5.5 Joint Test Failures
Where a weld fails the test, the Contractor shall cease welding and no further pipe installation shall be carried out. The Contractor shall review the jointing process and test commentary
to determine the cause of the unsatisfactory joint, the proposed corrective actions and report these to the Engineer, through a Non-Conformance Report (NCR) complying with IDS, clause 3.7.1- Control of non-conforming work. The diagram illustrates the process.

If the Engineer considers that the weld has failed for reasons beyond the approved welder’s control, the welding methodology shall be amended to incorporate any corrective actions arising from the NCR and then utilised for all subsequent welds.

If the non-conforming weld is due to the approved welder’s action, the Contractor shall remove the ‘previous’ joint for testing, as per the chronological order of jointing. The section of pipe from the location of the failed joint to the last passing test shall be quarantined and not installed. If the previous joint(s) are at a tee, these shall not be removed for testing and the next through (straight) joint shall be tested.

If this joint complies, the welder shall produce a ‘test’ joint.

Jointing shall not recommence until the NCR process is completed as above and the welder has received complying weld test results from the ‘previous’ joint and from the ‘test’ joint, as set out in the flow chart.

If either of the second joint tests (the ‘previous’ and ‘test’ joints) are unsatisfactory an NCR shall be produced and assessed as above.

If the failure of the ‘previous’ joint is not attributable to the approved welder, the Contractor shall remove the second to last ‘previous’ joint for testing. If the failure of the ‘test’ joint is not attributable to the approved welder, the NCR process shall be completed as above and jointing can recommence.

If the failure is due to the approved welder’s actions or the 2nd last ‘previous’ joint fails, the Contractor shall cease welding until an alternative approved welder is accepted through the Contract Quality Plan. If the 2nd last ‘previous’ joint passes, the NCR process shall be completed as above and jointing can recommence.

Continuing installation and backfill of pipe joints made prior to the ‘previous’ test failure may not occur until the Contractor has satisfied the Engineer that the joints in this pipe are satisfactory. This may require either that further joints are tested or that all the suspect joints are cut out and re-welded or a combination of both.
14.6 Flexible Pipe Ovality Test

An ovality test shall be carried out on gravity pipelines in accordance with clause 6.5 of AS/NZS 2566.2 “Buried flexible pipelines – Installation”. The test shall be carried out at least seven days after the pipe surround is laid. Deformation exceeding the specified amount shall be corrected or the pipe replaced.

14.7 Measurement of Work and Basis of Payment

The Contractor shall include the cost of all testing and associated work in the rate for pipe installation. This shall include test points in pressure pipes but shall exclude testing junctions for gravity pipes.
The remedying of defects made apparent by testing shall be at the Contractor’s cost.

14.7.1 Testing Junctions
Testing junctions shall include supply, installation and plugging after testing.

14.7.2 CCTV inspection
CCTV inspection shall include flushing and the provision of a video and written records to Council.

14.7.3 Polyethylene Pipe Weld Test
Payment for specified sampling, testing, re-jointing and reinstatement etc of joints shall be for each complying joint. The rate for electrofusion joint testing shall include for all time related effects associated with set up, testing, approval, re-jointing etc.

If additional testing is required due to a change in machine, operator, pipe supplier or material or to prove defective work, the additional tests and any related costs shall be borne by the Contractor.

15.0 BACKFILLING

Backfilling shall be carried out in accordance with CSS: Part 1 - General.

15.1 Prior to Backfilling

No backfilling shall be carried out until the Engineer has approved the method of backfilling and compaction.

No backfilling shall commence until all concrete, whether used in haunching, risers, manholes or other structures, has gained sufficient strength to support the loads that will be transmitted to it. All formwork shall be removed before backfilling.

15.2 Materials

Backfill to trenches shall be the specified imported material, unless the Engineer approves the use of the excavated material as backfill.

There will be no payment for handling of excavated material where used as backfill.

15.3 Backfill Procedure

Backfill shall be placed so that no sudden or excessive loading is transmitted to the pipeline or its accessories. The pipe shall not be moved
or damaged during placing or compaction of backfill. Particular care shall be taken to compact the backfilling around risers.

Well point, well or test holes shall be completely filled with coarse sand or approved alternative.

Where watering-in is used, the surface layer of the backfill, if segregated, shall be removed or treated.

15.4 Quality Assurance

The Contractor shall provide records of compliance tests carried out on trench backfill as required by CSS: Part 1 - General, to comply with IDS: Part 3 - Quality Assurance.

Records of these tests shall be supplied at regular intervals, to provide confirmation of ongoing testing. Details of the proposed methods and frequency of such activities, and the reporting of these, shall be set out in the Contractor’s Contract Quality Plan.

15.5 Measurement of Works and Basis of Payment

15.5.1 Imported Backfill

Imported backfill shall include the supply of backfill material to replace rejected material, any handling between the on-site stockpile and the trench and the removal and disposal of that rejected material. Imported backfill shall be paid by solid measure, to the nearest 0.1m³.

For concrete pipes, the volume shall be determined from the excavation width and the depth from the subgrade to the centreline of the pipe where the pipe diameter is 525mm or less. Where the pipe is greater than 525mm diameter, the depth shall be to the top of the pipe haunching and the volume shall be reduced by the volume of the pipe and surround above the level of the haunching. The trench width shall be ‘G’ or ‘N’ as specified for the excavation.

For flexible and ceramic pipes, the volume shall be determined from the trench width ‘G’ or ‘N’ and the depth from the subgrade to the top of the haunching or 150mm above the top of the pipe.

15.5.2 Filling to Unsuitable Foundations

Filling to unsuitable foundations shall be paid per m³ solid volume of fill placed, to the nearest 0.1m³, and shall include supply, placing, compaction and testing. Measurement of filling shall be determined from the volume of unsuitable foundations being filled.
15.5.3 Testing
Benkelman Beam testing shall be paid per manhole length or per 100m for pressure pipe for complying results. Backfill testing ordered by the Engineer using the nuclear densometer shall be paid per complying result.

The cost of all backfill compliance testing required under clause 15.4 – Quality Assurance shall be included in the rates for pipe laying.

16.0 ADJUSTING MANHOLES TO ALTERED SURFACE LEVELS

Manhole frames and tops shall be adjusted in accordance with SD 306.

16.1 Materials

All materials used shall comply with clause 12.2 – Quality Assurance.

Cast iron frames may be fixed into the rebates with asphaltic concrete or cement sand mortar or concrete with a 6mm maximum aggregate size. Accelerating admixtures may be used. Under no circumstances shall frames be concreted in at the time the margin is poured. Where asphaltic concrete is used the surfaces of the frame and concrete rebate shall be primed with bituminous emulsion and the asphaltic concrete placed and thoroughly rammed in 30mm layers.

16.2 Raising of Manhole Frames

The neck of a standard or flush manhole shall not be deeper than 600mm once adjusted.

Where the neck will not exceed this limit, apply the procedure relevant to the type of manhole.

16.2.1 Raising the Frame for a Standard Manhole within the Rebate
The 100mm frame of a standard manhole with a 100mm deep margin may be packed up on cement mortar or fine aggregate concrete and the top of the frame raised to a maximum of 65mm above the concrete surface provided the raised frame is laterally supported by asphaltic concrete. The maximum thickness of cement mortar to support frames shall not exceed 25mm. Concrete with a maximum aggregate size of 6mm shall be used to support frames for thicknesses over 25mm.

16.2.2 Raising the Frame for a Bottleneck Manhole
For “bottleneck” manholes the 200mm frames and concrete surround shall be removed and replaced with 100mm frames. The exterior dimensions of the cast in-situ manhole top shall not exceed the equivalent exterior dimensions of the manhole. The
new concrete top shall be reinforced with one peripheral 16mm diameter bar with 50mm cover. The existing brickwork shall be prepared in all areas where new concrete shall be poured against it.

16.2.3 Deepening the Rebate
Perimeter concrete to the frame rebate shall be a minimum of 200mm wide at all points. Dimensions to the finished surface shall comply with SD 306.

16.3 Raising of Manhole Tops

Where the depth from the top of the frame to the underside of the slab exceeds 600mm, the top and walls shall be raised.

Standard manhole slab tops may be reused but the tops of “bottleneck” manholes with 200mm frames shall not be reused. In flush tanks, flush manholes and manholes with turning valves, the chain hook shall be relocated.

16.3.1 Standard Manholes
Vent structures shall be extended.

16.3.2 Bottleneck Manholes
The bottleneck shall be removed and either vertical walls constructed from the original springing or a precast manhole riser installed. Vent structures shall be rebuilt.

16.3.3 Precast Circular Manholes
Units shall be used to raise the top. If the adjustment required cannot be achieved solely by the use of riser rings then raise both the top and the frame.

16.4 Lowering the Surface Level

16.4.1 Standard Manholes without Vents
The concrete top shall be removed and the walls cut down the required amount. The top of the cut wall shall be made true and even with cement mortar and the top reset on a cement mortar bed.

16.4.2 Standard Vented Manholes with Removable Vent Gratings
When lowering less than 125mm, the vent may be adapted by cutting down the walls, to provide a vent opening height of 50mm with a vent upstand above the vent drain of 150mm. The top shall be treated as described in clause 16.4.1 – Standard Manholes Without Vents.

When lowering more than 125mm the vent must be completely rebuilt to the standard dimensions, after cutting the walls down
the required amount. To rebuild the vent a considerable portion of one manhole wall must be demolished and care shall be exercised to avoid damage to the remaining manhole structure.

Alternatively, a new style precast top with the vent located within the 900mm x 900mm manhole may be used and a vent box installed in the manhole. The old vent shall be broken down and sealed off.

16.4.3 Vented Manholes with a Fixed Vent Grating
The top may be lowered without altering the vent provided the soffit of the slab does not finish lower than the top of the vent opening pipe. Where this will occur, the vent may be completely rebuilt to its original size or a new style precast vented top used.

16.4.4 Bottleneck manholes.
Lowering of less than 100mm may be accommodated by fitting 100mm frames to replace 200mm frames, as described in clause 16.2.2 – Raising the Frame for a Bottleneck Manhole. If the top is to be lowered more than 100mm, the alteration shall be carried out as described in clause 16.3.2 – Bottleneck Manholes.

16.4.5 Precast Circular Manholes
The walls of the precast unit shall be cut down, taking special care to avoid spalling and/or cracking of the unit. After cutting down the top edge shall be reformed using the special former. An approved sealing strip shall be placed between any slab and extension to walls on precast manholes to form a watertight joint.

Alternatively, lowering may be achieved in some cases by removing one of the riser rings and replacing it with another of the appropriate height.

16.5 Protection of System

Before any alteration work is carried out on manholes or flush tanks, the existing inverts etc shall be covered with decking to prevent the entry of debris that could cause blockages.

16.6 Protection of Structures

Traffic shall be kept off all structures until they have achieved a strength of 25 MPa.

The use of steel plates to cover new concrete work and prevent traffic loading shall be permitted in accordance with CSS: Part 1 - General. It is essential however that there is sufficient clearance between the underside of the plate and the new concrete margin or newly bedded frame to enable traffic to pass over the top of the manhole without the load being transmitted to the new concrete work.
16.7 Measurement of Works and Basis of Payment

Adjusting manholes shall be paid as a lump sum per item. Adjustments to vents shall be included in this sum.

16.7.1 Manholes Adjusted Separately from Drainage Works
The rate shall include the restoration of the surrounding surface.

17.0 RESTORATION

Restoration shall be carried out in accordance with CSS: Part 1 - General and the Works Access Permit (WAP) conditions, where applicable. Apply for a Corridor Access Request (CAR) at www.beforeudig.co.nz.

17.1 Measurement of Works and Basis of Payment

Restoration from subgrade level shall be measured on the lineal metre of pipe installed, to the nearest 0.1m, which shall include restoration to any structures installed on the pipe. Restoration includes additional sawcutting, bandaging where necessary and additional sealing width as detailed in CSS: Part 1 clause 30.0 – Restoration and Final Surfacing.
CONCRETE CONSTRUCTION CHECKSHEET

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<th>Contractor:</th>
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<td>- Lap location and lengths</td>
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<td>- Starters correctly located</td>
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<td>- Dowels correctly positioned</td>
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<td>- Shear Keys</td>
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<td>- Reinforcement cut at joints</td>
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<td>- Additives</td>
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<td>7 Special Requirements</td>
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<tr>
<td>- Local Authority informed prior to pour</td>
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<tr>
<td>- Engineer informed prior to pour</td>
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Pre-Pour Check:
Concrete Inspector’s Name/Signature/Date
Time of Commencement of Pour
Completion:
Pour satisfactorily complete Name/Signature/Date
Sawcutting of slabs
Curing being carried out
(Note on reverse any problems experienced during the POUR)
GENERAL REQUIREMENTS FOR SITE BUTT FUSION JOINTING

a) Check the pipes and fittings to be welded to confirm they are as specified and of the same diameter, wall thickness and PE material.
b) Provide a tent or shelter, if necessary, to protect the jointing process.
c) Cover the exposed ends of the pipe strings until they are welded, to prevent any air flow which may heat or cool the pipe.
d) The covers shall be carefully cleaned and wiped dry before proceeding.
e) Site the butt fusion machine on a clean, level and firm surface that provides adequate stability.
f) Cut the pipe ends square.
g) Support the pipes to be jointed on rollers spaced to achieve the specified alignment and to minimise the drag pressure.
h) Set the pipes so that the manufacturer's markings are aligned and the pipes can be laid uppermost in the trench, to allow for future identification without major excavation work.
i) Open and close the clamps. Note the gauge pressure required to close the clamps is the drag pressure.
j) Securely clamp the pipes or fittings in position so that they cannot move unless moved by the clamping device.
k) Check the generator has sufficient fuel and is performing correctly before it is connected to the machine.
l) Check it is compatible with the welding equipment (e.g. power output, rating etc).
m) The pipe profiles should be re-rounded if necessary.
n) Check the temperature of the pipe and/or fittings prior to jointing. Should low temperatures be encountered (< 5ºC) operations should be delayed until the temperature has increased. If it is necessary to undertake jointing at temperatures < 5ºC, additional precautions may be necessary e.g. heating the jointing shelter or contacting the pipe manufacturer for additional guidance. Any joints carried out at temperatures < 5ºC shall be subjected to closer than normal scrutiny.
o) Use the facing machine to trim and plane the pipe ends.
p) Bring the mating faces together and check that the mismatch in alignment or diameter complies with the specification. Re-trim the ends and re-align the pipes if the mismatch doesn’t comply.
q) Remove all shavings and trimmings. The machined faces of the pipe or fitting shall not be touched as this will contaminate the joint interface. If the trimmed ends of the pipe/s become contaminated they shall be re-faced.
r) Check the heater plate for any signs of damage.
s) If the heater plate needs cleaning, allow it to cool first then wash with clean water and a lint-free cloth. Dry thoroughly. Non-depositing alcohol may be used to remove any oil or grease.
t) Place the heater plate in the machine and bring it up to the specified temperature.
u) Check that the temperature on both sides of the plate is within the allowable range.
v) At the start of each jointing session, a dummy joint (or joints) should be made to ensure that the heater plate has no fine adhesive particles remaining. The dummy joint may be aborted at the end of the heat soak period. Pipe offcuts may be used for these dummy joints.
w) Heat the pipe ends and make the joint.
x) Hold the fused joint immobile under pressure for the minimum cooling time.
y) Number each joint.
Check the joint bead appearance, its width and height and record all joint details on the site jointing log sheet.
# COMPLIANCE REQUIREMENTS CHECKSHEET - DRAINAGE

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<tr>
<th>ITEM</th>
<th>CSS Ref</th>
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<th>TEST FREQ.</th>
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<td>CQP DOCUMENTATION</td>
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<td>EQUIPMENT</td>
<td>AS/NZS 2033, manuf reqs</td>
<td>Appropriate clean equipment, re-rounding clamps, specified cleaners</td>
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<td><a href="http://www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx">www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx</a></td>
<td>Manufacturer confirmed compatibility; witness mark location; fitting/pipe gap</td>
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<td>Pt 3</td>
<td>PIPE PREPARATION</td>
<td>measure</td>
<td>‘Out of roundness’ less than 1.5%, end gaps, pipe dimensions comply, pipes</td>
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<td>AS/NZS 2033, manuf reqs</td>
<td>Cleaned and protected, witness marks, pipe insertion</td>
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<td>Pt 3 14.4.3</td>
<td>During construction tests</td>
<td>ISO 13954, ISO 13955</td>
<td>Correct parameters, pipe position, visual inspection satisfactory, weld marked, fusion times complied with, welding records kept</td>
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<td>Pt 3 7.3.2</td>
<td>Cooling period</td>
<td>AS/NZS 2033, manuf reqs</td>
<td>Pipe not moved for specified period.</td>
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### 6 BUTT WELDING

- **Pt 3 7.4** Preconstruction tests ISO 13953 Passing tests received, pipe batch, machine and welder named
- **Pt 3 7.4.1, 7.4.2** CQP documentation POP003 Present methodology and QA records through CQP
- **Pt 3 7.4.3** Operator qualified NZWETA accred butt qual Present copy through CQP, including current experience at relevant diameter
- **Pt 3 7.4.4** Equipment AS/NZS 2033, manuf reqs Equipment clean, appropriate, plate temperature constant and as specified, re-rounding clamps, specified cleaners.
- **Pt 3 3.0** Fittings and materials [www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx](http://www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx) Manufacturer confirmed compatibility; witness mark location; fitting/pipe gap
- **Pt 3 7.4.5** Pipe preparation Measure, manuf reqs, POP003 End alignment and end gaps comply, pipes cleaned and protected, ends protected, air temperature above 4ºC
- **Pt 3 Welding** AS/NZS Welding records kept, weld marked,
## PIPE INSTALLATION BY TRENCHING

<p>| Pt 3 8.0 | As-builting | measure | Records taken before backfilling |
| Pt 3 8.1 | Pipe laying | measure | To within ±10mm of design invert. Within 50mm or 5% of dia in horz plane |
| Pt 3 8.1.2 | Laser set up | measure | Light beam on grade and line |
| Pt 3 8.5.1 | Metal haunching material | TNZ req or CSS Part 1 | Grading |
| Pt 3 8.5.1 | Metal haunching depth | SD 344 | to chart |
| Pt 3 8.5.1 | Metal haunching and bedding | test | Compaction complies |
| Pt 3 8.5.2 | Concrete capping | SD 332 | to chart |
| Pt 3 8.5.3 | Concrete surround | SD 342 | 100mm cover |
| Pt 3 8.5.4 | Concrete protection | SD 342 | 100mm depth |
| Pt 3 8.5.6 | Geotextiles | inspect | All joints wrapped |
| Pt 3 8.7 | Flexible pipe laying | measure | ‘Out of roundness’ less than 5% |
| Pt 3 8.7 | Pressure pipe laying | SD 344 | To chart |</p>
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<td>8.8</td>
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<td>Pressure pipe laying</td>
<td>Site test</td>
<td>Soil capacity complies with design</td>
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<td>8.8</td>
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<td>Thrust blocks</td>
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<td>Metal haunched, fittings compatible and correct, no leakage</td>
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<td>Vertical riser installation</td>
<td>SD 363</td>
<td>Concrete surround complies</td>
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**8 PIPE INSTALLATION BY TRENCHLESS TECHNOLOGY**

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<tr>
<td>9.1</td>
<td>Pt 3</td>
<td>Pipe pulling</td>
<td>AS/NZS 2033, manuf reqs</td>
<td>Load does not exceed that specified. Gouging, notching under 10% wall thickness for pressure pipe and 20% for gravity pipe.</td>
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**9 PIPE INSTALLATION BY DIRECTIONAL DRILLING**

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<td>Pipe laying at structures</td>
<td></td>
<td>No leakage</td>
<td></td>
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<tr>
<td>Pt 3</td>
<td>Yield joints</td>
<td>SD 341</td>
<td>Yield joints comply</td>
<td></td>
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<tr>
<td>Pt 3</td>
<td>Polyethylene connections</td>
<td>SD 341</td>
<td>Joints comply</td>
<td></td>
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<tr>
<td>12</td>
<td>STRUCTURES (ADDITIONAL TO APPENDIX 1)</td>
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<tr>
<td>Pt 3</td>
<td>Locate structure</td>
<td>measure</td>
<td>Within 50mm of design horizontally</td>
<td></td>
<td></td>
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<tr>
<td>Pt 3</td>
<td>Construct flush tank</td>
<td>SD 311</td>
<td>Structure is watertight.</td>
<td></td>
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<tr>
<td>Pt 3</td>
<td>Construct manhole</td>
<td>SD 303</td>
<td>Structure is watertight.</td>
<td></td>
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<tr>
<td>Pt 3</td>
<td>Fittings and materials</td>
<td>SD 301, SD 303</td>
<td>Approved materials used.</td>
<td></td>
<td></td>
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<tr>
<td>Pt 3</td>
<td>Construct benching</td>
<td>SD 303</td>
<td>Concrete is 25 MPa.</td>
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<td>Pt 3</td>
<td>Install risers</td>
<td>SD 303</td>
<td>Riser gaps less than 5mm.</td>
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<td>Pt 3</td>
<td>Install tops</td>
<td>SD 303</td>
<td>Approved materials used.</td>
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<td>ITEM</td>
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<td>TEST STD/ DESCRIPT</td>
<td>COMPLIANCE REQUIREMENTS</td>
<td>TEST FREQ.</td>
<td>PASS YES/NO</td>
<td>TEST BY</td>
<td>ACTIONS</td>
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<tr>
<td>Pt 3 12.13</td>
<td>Install ironwork</td>
<td>measure</td>
<td>Mortar between 10mm and 25mm.</td>
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<tr>
<td>Pt 3 12.14</td>
<td>Install AGS</td>
<td>SD 317</td>
<td>Operates correctly and connections watertight.</td>
<td></td>
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</table>

**13 PERFORMANCE TESTING**

<p>| Pt 3 14.1 | Test equipment | inspect | Gauges read twice test pressure. Gauges and meters calibrated. | | | | | |
| Pt 3 14.2.5 | Gravity pipe air test | measure | Pressure drop shall not exceed 2 kPa in 2 mins. | | | | | |
| Pt 3 14.2.4 | Gravity pipe hydrostatic test | measure | Water level does not drop for 5 mins | | | | | |
| Pt 3 14.2.3 | Gravity pipe visual inspection | inspect | No leaks or defects visible. | | | | | |
| Pt 3 14.2.6 | Gravity pipe CCTV inspection | inspect | No defects visible. | | | | | |
| Pt 3 14.3 | PVC PE pressure pipe water test | AS/NZS 2566.2 | pressure loss within tolerances | | | | | |
| Pt 3 14.3.1 | Concrete pressure pipe water test | measure | pressure loss within tolerances. | | | | | |
| Pt 3 14.3.2 | Polyethylene pipe pressure test | measure | Shape of pressure plot within tolerances. | | | | | |
| Pt 3 14.3.3 | Polyethylene pipe pressure test | measure | Shape of pressure plot within tolerances. | | | | | |
| Pt 3 14.4 | Polyethylene Pipe Welds | AS/NZS 2033 | Satisfactory visual inspection | | | | | |
| Pt 3 14.4.1 | Polyethylene Pipe Preconstruction Weld Tests - Electrofusion | ISO 13955 | Joint shall pass test | | | | | |
| Pt 3 14.4.2 | Polyethylene Pipe Preconstruction Weld Tests – Butt fusion | ISO 13953 | Ductile failure | | | | | |</p>
<table>
<thead>
<tr>
<th>ITEM</th>
<th>CSS REF</th>
<th>TASK</th>
<th>TEST STD/ DESCRIP</th>
<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
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<tr>
<td>Pt 3 14.4.3</td>
<td>Polyethylene Pipe Construction Tests - Electrofusion</td>
<td>ISO 13955</td>
<td>Joint shall pass test</td>
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<td>Pt 3 14.4.4</td>
<td>Polyethylene Pipe Construction Tests – Butt fusion</td>
<td>ISO 13953</td>
<td>Ductile failure</td>
<td></td>
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<tr>
<td>Pt 3 14.4.6</td>
<td>Flexible pipe ovality test</td>
<td>measure</td>
<td>‘Out of roundness within tolerances.</td>
<td></td>
<td></td>
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</tbody>
</table>

### BACKFILLING

| Pt 3 15.2 | Backfill material in road | TNZ req | To be M/4:AP40 | | | | |
| Pt 1 27.3 | Determine dry density of backfill material in path | NZS 4402 | Standard Proctor | | | | |
| Pt 1 27.5.1 | Compact backfill | Clegg hammer | 35 in road, ROW or commercial crossing, 25 elsewhere | | | | |
| Pt 1 27.0 | Compact backfill | MDD by ND | 95% in road, ROW or commercial crossing, 90% in path, 70% elsewhere | | | | |

### RESTORATION

<p>| Pt 1 28.1 | Surface preparation | inspect | Sawcut edges in permanent surfaces, strip to fender where within 1.5m | | | | |
| Pt 6 6.5 | Presealing surface shape - path | measure | Max 10mm gap, cumulative total gap under 25mm | | | | |
| Pt 1 28.1 | Presealing surface shape - berm | measure | 75mm below existing surface | | | | |
| Pt 6 11.4 | Presealing surface shape - road | measure | Max 12mm gap, cumulative total gap under 25mm in both directions | | | | |
| Pt 6 6.8 | Sealed surface shape - path | measure | Max 5mm gap, cumulative total gap under 20mm for longitudinal 3m straightedge and under 10mm for transverse 1m straightedge | | | | |</p>
<table>
<thead>
<tr>
<th>ITEM</th>
<th>CSS REF</th>
<th>TASK DESCRIPT</th>
<th>TEST STD/MEASURE</th>
<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
<th>ACTIONS</th>
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<tbody>
<tr>
<td>Pt 2</td>
<td>9.5.3</td>
<td>Finished surface shape - berm</td>
<td>measure</td>
<td>+10mm, -0mm of existing level</td>
<td></td>
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<tr>
<td>Pt 6</td>
<td>14.4</td>
<td>Chipsealed surface shape - road</td>
<td>measure</td>
<td>Surface to be convex, mate-ins to be flush</td>
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<tr>
<td>Pt 6</td>
<td>17.5</td>
<td>AC surface shape - road</td>
<td>measure</td>
<td>Max 5mm gap, cumulative total gap under 10mm for longitudinal 3m straightedge</td>
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<tr>
<td>Pt 1</td>
<td>28.1</td>
<td>Surfacing</td>
<td>inspect</td>
<td>Bandage AC edges, overlap chipseal</td>
<td></td>
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</table>
HPT = Heater plate temperature  P1 = Initial bead pressure  T1 = Bead press time
P2 = Heat soak pressure  T2 = Heat soak press time
P3 = Welding pressure  T3 = Change over time
          T4 = Time to reach weld pressure
          T5 = Welding + Cooling time

**BUTT PIPE WELD LOG SHEET**

<table>
<thead>
<tr>
<th>Project</th>
<th>Pipe/Material Details</th>
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<tbody>
<tr>
<td>Contractor ID No</td>
<td>Weld Machine Details</td>
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<table>
<thead>
<tr>
<th>Date</th>
<th>Weld No</th>
<th>HPT °C</th>
<th>P1 kPa</th>
<th>T1 Sec</th>
<th>P2 kPa</th>
<th>T2 Sec</th>
<th>T3 Sec</th>
<th>T4 Sec</th>
<th>P3 kPa</th>
<th>T5 Sec</th>
<th>Operator Signature</th>
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<td>Date</td>
<td>Weld No</td>
<td>Fitting Details*</td>
<td>Location of weld</td>
<td>Pipe Batch</td>
<td>O %</td>
<td>D mm</td>
<td>RF Sec</td>
<td>RC Sec</td>
<td>AF Sec</td>
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</table>

*Details = manufacturer, barcode number

O = Ovality of pipe
D = Outside diameter (using pipe tape)
TA = Ambient temperature
RF = Recommended fusion time
RC = Recommended cooling time
AF = Actual fusion time
AC = Actual cooling time
PERMISSIBLE VARIATIONS IN DIMENSIONS

**FRAME**
- Cover opening diameter: +/- 2.0mm
- Cover opening depth: +/- 15mm, +/- 1.0mm
- Height: +/- 2.0mm
- Flange: +/- 3.0mm
- Clear Opening: +/- 1.0mm, +/- 3.0mm

**COVER**
- Cover diameter: +/- 2.0mm
- Seal depth: +/- 1.0mm, +/- 1.5mm

NOTES:
1. Manufacture of all covers to be in accordance with AS 3996-2006
2. Material: Grey Iron, Grade T 220 of AS 1830
3. Avoid sharp corners at the rib joints of the cover
4. Set weight: circular manhole 89 Kgs (Tolerance: +/- 3%)
5. Key holes to extend through whole lid.
6. Sump grates to be AS 3996 Class C.
1. Sections A-A & B-B are perpendicular to kerb.
NOTES:

1. Manufacture to be in accordance with the Material Approval.
2. Lid to show - Suppliers Name,
   - Load Test Standard BS EN124 Class D400.
3. Manufacture to AS 3996 Class D.
1. Bench junctions in accordance with SD303/4.
NOTES:
1. For manhole top slab reinforcing steel refer to SD302/3.
2. Precast tops to be seated on a cement sand mortar bed. Excess mortar on inside of MH to be struck clean.
3. MH and Vent Frames to be seated on 15mm min. up to 40mm max. of cement sand mortar.
4. 2 M12 cast in fixings in precast tops for lifting.
5. Form channels in benching in smooth easy curves as directed.
6. See also the notes on SD303/3.
7. See plan SD301/1, 2, 3 & 7 for manhole frames & lids.
8. Concrete work to comply with NZS 3109.
9. All concrete to be 40MPa.
NOTES:
1. All concrete to be 40 MPa.
2. All manhole tops to be precast.
3. Design Loading: HN-HO-72

UNVENTED MH PLAN

SECTION A-A

VENTED MH PLAN

Christchurch City Council

SQUARE MANHOLE TOPS
REINFORCEMENT

SD302
1) Notes on SD303/3 apply.
2) For manhole top slab reinforcing steel refer to SD303/2.

VENT BOX DETAILS

Install 2-D12 bars from corbel into benching.
See Plan SD341 & SD342 for details of pipe laying at MH.

NOTES:

CIRCULAR PRECAST MANHOLES FOR PIPES UP TO 400 OD

Christchurch City Council

SD303

MAR 2013

ISSUE DATE

SHEET 1 of 4

PLAN OF PRECAST M.H. TOP

PLAN OF PRECAST VENTED M.H. TOP

JOINTING DETAILS FOR TOP, SPACER RINGS & MANHOLE UNITS

SD30301E

Construction sealant

Precast Spacer Ring - see Note 3 plan SD 303/3

100mm Fibre Cement Board Vent Box 450 L x 230 D x 230 W at ends with 20mm drain hole, fix to MH wall with epoxy adhesive.

1050 precast manhole units

150 TNK precast Base supplied with lower MH unit.

2-D12 bars (see note Pt, Section B-B)

1475

1 in 3

Benching

Corbel to SD341

Crushed Metal

140

150

50

150

520

1340

110

150

200

520

85

125

85

1475

75

260

120

150

50

150

85

120

85

Benching

Corbel

Base Rein, D12

Manhole Top

100mm precast riser

Type 1050

SECTION A-A

Type 1050

SECTION B-B

Type 1050

Pt SECTION B-B

SECTIONAL PLAN OF M.H.
2. All manhole tops to be precast.
3. Design Loading: HN-HO-72

NOTES:

1. All concrete to be 40 MPa.
2. All manhole tops to be precast.
3. Design Loading: HN-HO-72
NOTES:
1. Joints shall not exceed 5mm at any point.
2. All joints are to be positioned as high as possible.
3. A 100mm riser shall be placed immediately below the manhole top. Use the deepest risers possible to achieve the height, to minimise joints.
4. Construction sealant shall be used for sealing all joints. All joints shall be clean. Jointing work shall be protected from rain. All sealant joints shall be butted, with a short overlapping piece on the outside.
5. Benching details shall be in accordance with SD302/1.
6. Circular base precast manholes shall be used for pipes up to 400mm OD, square base precast manholes for pipes up to 750mm.
7. Maximum Depth (G.L. to Invert) for standard manholes shall be 5m.
8. Resistance to flotation is dependent on well compacted backfilling.
9. Unused Knockout panels to be filled to full wall width.
NOTES:

1) Fall from 100° lateral invert to outlet invert of main line sewer shall be 50mm.

2) This requirement applies to manholes at the top end of a sewer line only.

NOTE:

1) Benching to SD302/1
<table>
<thead>
<tr>
<th>Nominal Pipe Diameter</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>225</th>
<th>250</th>
<th>300</th>
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<tr>
<td>Maximum angle of deviation for Narrow Manhole</td>
<td>A</td>
<td>30°</td>
<td>26°</td>
<td>20°</td>
<td>20°</td>
<td>18°</td>
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**NOTES:**
1. Notes on sheet SD302/2 apply.

---

**SECTION A-A**

For benching detail see SD 302/1

**SECTION B-B**

Max Depth to invert 3000

**SECTION A-A**

(FOR PRECAST TOP)

**PLAN**

Rectangular manhole frame & cover to SD301/7

**A**

<table>
<thead>
<tr>
<th>Fall 130</th>
<th>Fall 800</th>
<th>HD12</th>
<th>A</th>
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**INACCESSIBLE MANHOLE**

SD304

Christchurch City Council

ISSUE DATE | DEC 2009

 SHEET 1
IN MANHOLES

DROP STRUCTURE

SD305

PLAN

IN STANDARD MANHOLE

SECTION A-A

DROP INSTALLATION

SECTION B-B

DROP INSTALLATION

CIRCULAR PRECAST MANHOLE

NOTES:

1. Drop structures over 225° require special design.

2. Manholes to be constructed as detailed on plans SD302 & 303. Pipelaying at manholes to be constructed as detailed on plan SD341.

3. Channeling in new manholes shall be vertical to top of main sewer and benching graded at 1 in 3 or 1 in 8 as applicable.

4. Benching and channeling in existing manholes shall be reformed in easy curves.

5. In standard and precast manholes where the main sewer exceeds 600° a channel shall be formed in the benching under pipe 3. A 135° bend 4 shall not be used.

6. In existing manholes steps or ladders shall be relocated if required to permit access.

7. Opening for manhole starter and corbel shall be clear of any joint in precast manhole by at least 300mm.

PARTS LIST:

1. PVC RRJ pipe 88° back inspection bend.

2. 25mm wide x 1.25mm 316 stainless steel strap fixed to manhole wall with 2 - 38mm x 10 gauge stainless steel self tapping screws and rawl plugs.

3. PVC pipe.

4. PVC pipe 135° bend.

Christchurch City Council

DROP STRUCTURE IN MANHOLES

SD305

ISSUE DATE DEC 2009

SHEET 1
TOP ADJUSTMENT

Manhole raising

as per SD301
C.I. Lid & Frame
Manhole top
Standard precast
Manhole riser
Precast square manhole walls
Existing bottleneck of existing manhole
Broken down walls all round
Concrete corbel
Manhole riser to position & level
Concrete wedges

LEVEL ADJUSTMENT

BOTTLENECK MANHOLE

New ground level
Replace existing manhole top
1 as shown 1 or use
new manhole top
as per SD302
C.I. Lid & Frame to be removed & reused
Raise walls of manhole in hatched area using
25 MPa concrete

Existing manhole top to be removed and reused if possible.
Existing manhole base to remain unaltered.

LEVEL ADJUSTMENT

SQUARE MANHOLE

New ground level
C.I. Lid & Frame as per SD301
Standard precast Manhole top
Precast square Manhole riser
Existing bottleneck manhole walls
Concrete corbel all round
Concrete wedges to position & level Manhole riser
Broken down walls of existing manhole

SD306
MANHOLE RAISING
TOP ADJUSTMENT

Christchurch City Council

ISSUE DATE MAR 2013

SHEET 1 of 2
DETAILS OF INSTALLATION OF 100mm FRAME TOP

TYPICAL BOTTLENECK MANHOLE SHOWING 200mm FRAME TOP
NOTES:

1. The nominal capacity of the flush tank (cubic metres) shall be as specified and shall equal the internal length “L” in metres.
2. Unless specified otherwise the length of the tank shall be parallel with the direction of the sewer.
3. For cast-iron frames and covers see SD301/1.
4. Where “L” exceeds 4m the floor slab and longitudinal wall shall be reinforced with 665mm mesh with 50mm internal cover.
5. Setting of flush tank top slab must allow for road crossfall.
6. See Plan SD313 for air gap separator.
7. All concrete to be 40 MPa.
8. Concrete work to comply with NZS 3109.
**NOTES:**

1. 80 Polypropylene Rope complete with hook.
2. Flush tank Plug.
3. PVC Insert.
4. 2 special PVC pipes.
5. 16mm eyelet.
6. All concrete to be 40 MPa.
NOTES:
1. See SD302 for further construction details.

Fix item 3 to manhole floor with 25mm x 1.25mm type 316 stainless steel strap and 2-38mm x 12 gauge stainless steel self tapping screws into plastic rawl plugs.

Cement Mortar Cradle separated from floor slab to allow for easy removal of special PVC pipe if required.

Fix item 3 to manhole floor with 25mm x 1.25mm type 316 stainless steel strap and 2-38mm x 12 gauge stainless steel self tapping screws into plastic rawl plugs.

8Ø Polypropylene rope complete with hook.
Flush tank plug.
Special PVC pipe.
18mm eyelet.
PARTS OBTAINABLE FROM THE COUNCILS PAGES ROAD STORE:
1. Top cap - PVC removable.
2. 10mm x 10mm hex socket head S.S. grub screw.
3. Cylinder 150mm PVC class C pipe with overflow.
5. Valve lever.
6. Valve assembly back plate.
7. Split pins.
8. Bell crank lever.
11. PVC float.
12. Washers.
13. Bottom cap - PVC cemented in place.
14. 38mm shower waste sealed in bottom cap.

PARTS NOT SUPPLIED WITH UNIT:
15. 15mm G.W.I. elbow.
16. 15mm G.W.I. pipe.
17. 15mm G.W.I. Johnson coupling.
18. 38 - 25mm G.W.I. reducing elbow.
19. 25mm G.W.I. pipe.
20. 25mm G.W.I. Johnson coupling.

NOTES:
1. Air gap separators shall be located within the limits shown in the diagram above.
2. Cistern shall be placed in footpath as close as possible to the road/property boundary and to a common lot boundary.
3. High pressure water connection shall be made to water main wherever possible but where connection has to be made to a small service pipe a flexible loop of 15mm polythene pipe shall be used between the water meter and the air gap separator cistern to reduce water hammer effects.
4. The float shall be adjusted by manipulating distance pieces to obtain water level 30 +/- 10mm above tank soffit, but enough adjustment will be left to allow W.L. to be set 30mm below tank soffit.
5. A special extended air gap separator will be required when ground level is too high, ie, standard barrel and float rod shall be extended by length E with maximum of 500mm. E = 0 mm for Standard air gap separator.
6. Low pressure 25mm pipe to be laid on grade, as shown, to prevent air locks and debris accumulation.
NOTES:
1. Concrete work to comply with NZS 3109.
2. All concrete to be 40 MPa.
3. Coat end faces of precast units with an approved epoxy tiecoat before jointing.
4. Use 50 x 50 x 8 Angle 700mm long (hot dipped galvanised) to support end of frame at K & F.C./K & D.C. junction.

SD321
SIDE ENTRY SUMPS
PRECAST KERB UNIT
ISSUE DATE DEC 2009
SHEET 1 of 2
Weld all round as shown 5mm Fillet

50 Long x 25 x 25 Cleat Hot dipped galvanised after fabrication.

102 x 51 x 10 M.S. Channel.
SIDE ENTRY
ENLARGED SUMP

SD322

150
560 for 450Ø pipe
150
840 for 525Ø pipe

250
50
230

200
450

525Ø

650Ø

102 x 51 x 700 Strut for Double Sump

890 min. for 450Ø
550 min. for 525Ø

Precast Kerb Unit

Standard Frame and Grating.

Christchurch City Council

ISSUE DATE  MAR 2013

SHEET 1 of 2
NOTES:

1. Notes on sheet SD321/1 apply.
2. Maximum cover to pipe to be:
   - 0.75m where a single sump is being installed.
   - 1.20m where a double sump is being installed.

SD322

Christchurch City Council

SINGLE ENLARGED SUMP

ISSUE DATE MAR 2013
SHEET 2 of 2
Precast Kerb Units

76 x 38 Channel at 460 crs max. welded to web grating.

50mm slot full depth in Conc. Nb.

Webforge WA 505 or equivalent. Weld grating to 76 x 38 Channel at each intersection point, H.D. galvanise after fabrication.

Pipe as specified.

Cross Bars on top.

Silt trap as alternative to conc. Nb if ordered.

NOTES:

1. Notes on sheet SD321/1 apply.
NOTES:
1. Notes on sheet SD321/1 apply.

SECTION A-A, B-B & C-C

SPECIAL GRATING

25mm dia rods length to suit, Weld to 50x12 flat plate, PROFILE end as above.

LENGTH AS SPECIFIED

Hot dip galvanise entire grating
NOTES:
1. Yield joints shall be provided in accordance with plan SD341 except that in all cases, two yield joints and one short pipe shall be used.
2. General method of pipelaying, angle connections, corbels, etc. to be in accordance with plan SD341.
3. Concrete work to comply with NZS 3109.
4. All concrete to be 40MPa.

Channel cast in walls (double sump only)
75 deep recess all round
Pipe as specified

Grating/Frame set 15 below channel level.
Depress channel 30 for 150 length each side,
580

SECTION A-A

SECTION B-B

SECTION C-C

PLAN
SINGLE SUMP

PLAN
DOUBLE SUMP

Christchurch
City Council

SINGLE & DOUBLE SUMPS
FLAT CHANNEL

SD325
1. Notes on sheet SD325 apply.
2. See SD301/3 for frame and cover details.

Top of grating 15mm below channel invert or grass areas (or flush with road surface where used in roadway).

Standard type grating either solid plate or holes for drainage as specified.

NOTES:

Finished Sump top levels on plan given to this point.

Pipe as specified.

200
150
380
150

SECTION A-A
HOUSE DRAIN SUMP
(PRIVATE PROPERTY ONLY
UNLESS OTHERWISE SPECIFIED)

Trafficable house drain sump frame & cover to DS3D1/2.
Standard type grating either solid plate or holes for drainage as specified.

Top of grating 15mm below channel invert or grass areas (or flush with road surface where used in roadway).

Finished Sump top levels on plan given to this point

SMALL TRAFFICABLE SUMP

SD328
NOTES:
1. General method of pipe laying, angle connections, corbels etc, to be in accordance with SD341.
2. Notes on sheet SD325 apply.
NOTES:

1. Concrete protection shall extend to a pipe joint.

2. Concrete surround, reinforced at commercial crossings only. Reinforcement to extend each side of a commercial crossing by 1.5m minimum to a pipe joint.

3. Concrete surround shall be a minimum of 20 MPa 100mm slump with a tolerance of +20,-20mm.

4. Yield joints shall be formed at pipe joints by interrupting concrete with 12mm Softboard or equivalent and applying pipe clay or similar to the pipe joint to prevent entry of concrete. Any reinforcing steel shall be stopped unhooked 50mm from joint.

5. Pipe dia. | Min depth to invert | Conc. surround width | Protection depth | Pipe offset from kerb face
---|---|---|---|---
225 | 660 | 570 | 520 | 180
300 | 740 | 640 | 600 | 210

6. Yield joints are not required at structures provided reinforced concrete surround is rebated 50mm into structure walls (to prevent shear failure).

7. Concrete pipe to Class 2 unless otherwise specified.
NOTES:

1. Concrete protection shall extend to a pipe joint.
2. Concrete strength to be 20 MPa 100mm slump, with a tolerance of ±0.20mm.
3. Pipes shall be Class 4 unless otherwise specified.
4. Concrete capping reinforced at commercial crossings only. Reinforcement to extend each side of a commercial crossing by 1.5m minimum to a pipe joint.
5. Contraction joints shall be formed at pipe joints by interrupting concrete with Softboard or equivalent, sealed to prevent grout entry with approved sealant. Any reinforcing steel shall be stopped unhooked 50mm from joint.
6.

<table>
<thead>
<tr>
<th>Pipe Dia.</th>
<th>Min depth kerb to invert</th>
<th>Capping width</th>
<th>Protection depth</th>
<th>Pipe offset from kerb face</th>
</tr>
</thead>
<tbody>
<tr>
<td>375</td>
<td>810</td>
<td>770</td>
<td>350</td>
<td>250</td>
</tr>
<tr>
<td>450</td>
<td>850</td>
<td>830</td>
<td>400</td>
<td>200</td>
</tr>
<tr>
<td>525</td>
<td>950</td>
<td>910</td>
<td>440</td>
<td>160</td>
</tr>
</tbody>
</table>

7. Yield joints shall be constructed at sumps with one short pipe and two yield joints.
GENERAL METHOD OF PIPELAYING AT MANHOLES AND SUMPS

ANGLE CONNECTIONS

SECTION A-A

CORBEL DETAILS

Applies to straight & angle connections. Angle connections will be permitted for 100° to 300° pipelines, Special design required for pipes greater than 300°.

NOTES:

1. Pipelines that are concrete haunched or concrete surrounded shall have the concrete interrupted at each yield joint with softboard or equivalent.

2. Ceramic and vertically cast short pipes shall be minimum of 500mm & maximum of 800mm long.

3. For reinforced concrete short pipes the following table shall apply.

<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>MIN</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>600</td>
<td>800</td>
</tr>
<tr>
<td>150</td>
<td>750</td>
<td>1000</td>
</tr>
<tr>
<td>200</td>
<td>900</td>
<td>1200</td>
</tr>
<tr>
<td>250</td>
<td>1100</td>
<td>1450</td>
</tr>
<tr>
<td>300</td>
<td>1300</td>
<td>1700</td>
</tr>
<tr>
<td>350</td>
<td>1500</td>
<td>1900</td>
</tr>
<tr>
<td>400</td>
<td>1700</td>
<td>2100</td>
</tr>
</tbody>
</table>

4. At each pipeline connecting to a manhole or sump, the No. of short pipes and yield joints shall comply with the following table:

<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>SHORT PIPES</th>
<th>YIELD JOINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 to 525</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>600 to 675</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>750 to 2100</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sump</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

5. This pipe may be double spiral pipe with a socket, finisher in the manhole wall with Engineer’s approval. Maximum length pipe 1300mm, minimum length 450mm.

6. Corbeling where suitable pipe lengths are not available shall only be used with the Engineer’s approval. For corbeling on precast manholes see SD303/1.

7. Gibault joints shall not be used as yield joints unless approved by the Engineer,
NOTES:
1. Sump starters and finishers to plan SD343.
3. Sump short pipes shall have a minimum length of 700mm & a maximum of 1000mm.
4. On each pipeline connecting to a sump there shall be one short pipe and two yield joints.
5. Pipes may be laid straight through manhole but must be gritted.
PIPELAYING AT MANHOLES FOR PE PIPES

SD341

ISSUE DATE MAR 2013

SHEET 3 of 4
PVC Long Socket Connection to Manhole

Long Socket MH Connector with same ID as Standard socket - full length

Pipe grit coated

200

200

260 min

PVC Long Socket Manhole Connector
1. For diameters greater than 450mm, special design applies.

2. Concrete shall be 20 MPa 100 slump with a tolerance of +0.20mm.

3. Type of surround shall be specified.

4. Concrete surround shall terminate at a pipe joint.

5. Contraction joints shall be formed at pipe joints by interrupting concrete with 12mm Softboard or equivalent and applying approved sealant to the pipe joint to prevent entry of concrete. Any reinforcing steel shall be stopped unhooked 50mm from joint.

6. Contraction joint spacing - maximum:

<table>
<thead>
<tr>
<th>R.C.R.R.</th>
<th>Ceramic Pipes or vertically cast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>10m</td>
</tr>
<tr>
<td>Type B</td>
<td>5m</td>
</tr>
<tr>
<td>Type C</td>
<td>Engineer to specify</td>
</tr>
<tr>
<td>Type D</td>
<td>1m</td>
</tr>
</tbody>
</table>

7. With flexible pipe, Type E protection to be used unless otherwise specified.
PVC MANHOLE STARTERS
AND FINISHERS

SD343

FOR STRAIGHT THROUGH, 90° & CIRCULAR MANHOLES

FOR ANGLE MANHOLES

**MANHOLE STARTERS**

<table>
<thead>
<tr>
<th>Pipe DN</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>144</td>
<td>150</td>
<td>50</td>
<td>344</td>
</tr>
<tr>
<td>150</td>
<td>129</td>
<td>150</td>
<td>50</td>
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<td>175</td>
<td>113</td>
<td>150</td>
<td>50</td>
<td>313</td>
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<tr>
<td>225</td>
<td>95</td>
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<td>50</td>
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</tr>
<tr>
<td>300</td>
<td>82</td>
<td>150</td>
<td>50</td>
<td>282</td>
</tr>
</tbody>
</table>

**MANHOLE FINISHERS**

<table>
<thead>
<tr>
<th>Pipe DN</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>80</td>
<td>150</td>
<td>265</td>
<td>495</td>
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<tr>
<td>150</td>
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<td>175</td>
<td>80</td>
<td>150</td>
<td>272</td>
<td>502</td>
</tr>
<tr>
<td>225</td>
<td>80</td>
<td>150</td>
<td>278</td>
<td>506</td>
</tr>
<tr>
<td>300</td>
<td>80</td>
<td>150</td>
<td>290</td>
<td>520</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pipe DN</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>110</td>
<td>250</td>
<td>230</td>
<td>590</td>
</tr>
<tr>
<td>150</td>
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<tr>
<td>175</td>
<td>140</td>
<td>250</td>
<td>260</td>
<td>650</td>
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<tr>
<td>225</td>
<td>120</td>
<td>250</td>
<td>280</td>
<td>700</td>
</tr>
<tr>
<td>300</td>
<td>150</td>
<td>250</td>
<td>310</td>
<td>770</td>
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</table>
**CONCRETE PIPES**

**DETAILS FOR PIPELAYING HAUNCHING**

**SD344**

---

**Metal Haunching**

<table>
<thead>
<tr>
<th>PIPE Dia (D)</th>
<th>DEPTH A</th>
<th>E</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>75</td>
<td>145</td>
<td>450</td>
</tr>
<tr>
<td>150</td>
<td>100</td>
<td>170</td>
<td>650</td>
</tr>
<tr>
<td>200</td>
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<td>150</td>
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<td>350</td>
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<tr>
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<td>450</td>
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<td>1600</td>
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<tr>
<td>2100</td>
<td>150</td>
<td>500</td>
<td>2900</td>
</tr>
</tbody>
</table>

---

**NOTES:**

1. Lime stabilise haunching where the trench backfill is lime stabilised.
NOTE:

1. Where specified the haunching shall be fully wrapped in accordance with TNZ F/7 in geotextile of strength class C.

2. Wrap pipe to 0.5m each side of all joints, including laterals in the specified geotextile. Secure the geotextile snugly to the pipe using cable ties or similar.

3. Suitable for soils with an allowable bearing pressure over 50kPa.

**TYPE P**

Standard Haunching

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter DN</th>
<th>Trench Width # G</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>450</td>
</tr>
<tr>
<td>150</td>
<td>500</td>
</tr>
<tr>
<td>175</td>
<td>550</td>
</tr>
<tr>
<td>225</td>
<td>600</td>
</tr>
<tr>
<td>300</td>
<td>650</td>
</tr>
<tr>
<td>375</td>
<td>750</td>
</tr>
</tbody>
</table>

* G may be increased in very soft ground.
NOTES:

1. Where the depth to the base of the foundation may exceed 3.0m from the finished ground level, site specific design is required.

2. Geotextile laps and wrapping shall be in accordance with TNZ F/7.
**NOTE:** Faces J, L & N to be poured against natural ground
See specification.

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Height (m)</th>
<th>Cover (m)</th>
<th>90° Bend (m)</th>
<th>45° Bend (m)</th>
<th>22.5° &amp; 11.25° Bend (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>300</td>
<td>200</td>
<td>300</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td>125</td>
<td>375</td>
<td>200</td>
<td>350</td>
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<td>225</td>
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<td>900</td>
<td>300</td>
<td>900</td>
<td>700</td>
<td>350</td>
</tr>
</tbody>
</table>

**HORIZONTAL BENDS ONLY**

**NOTES:**

1. Thrust block designed for an allowable bearing load of 50 kPa at pipeline pressure 390 kPa.
2. Thrust blocks in unsuitable soils require special design.
3. Concrete to be 17.5 MPa 150 slump unreinforced.
4. Do not use for upward thrust (special design only).
5. PVC pipes adjacent to concrete shall be wrapped with 6mm Denso tape or 250 microns Polyethylene film or equivalent.
Pour water stop against undisturbed ground.

PVC pipe shall be protected with 6mm thickness of Denso Tape or 250 microns Polyethylene film or equivalent where it passes through the water stop.

150mm Thickness of 15 MPa 150 slump Concrete.
NOTES:

1. Special design required for:
- Main pipes other than reinforced concrete;
- More than one connection per main pipe.

2. Direct connections of this type are not permitted on plastic mains.

3. Outside edge of main pipe cut-in hole shall be not less than 300mm from collar or end of pipe.

4. Maximum diameter of cut-in hole shall be less than two thirds of the internal diameter of main pipe.

5. Epoxy mortar shall be applied strictly according to the manufacturer’s recommendations, and shall be fully cured before the corbel is poured and the sideline laid.

6. Main pipe backfill under sideline shall be thoroughly compacted APAC metal.

7. Main pipe surface shall be roughened and grout coated before concrete corbel is poured.

8. Sidelines shall have yield joints in accordance with standard detail plan SD341.

9. Sidelines shall be tested.

10. Direct connections must be approved by the Engineer, and normally shall only be used where the sideline is less than 10m long, and access for cleaning the sideline is easily obtainable at the upstream end. That is the sideline shall terminate with a manhole or shallow sump, but not a deep sump.

11. Diameter of sideline pipe shall be less than half the internal diameter of main pipe.

SQUARE RADIAL DIRECT CONNECTIONS:

<table>
<thead>
<tr>
<th>Nominal Sideline Diameter</th>
<th>Minimum Main Pipe Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>225</td>
</tr>
<tr>
<td>150</td>
<td>275</td>
</tr>
<tr>
<td>200</td>
<td>375</td>
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<tr>
<td>225/250</td>
<td>450</td>
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<td>300</td>
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<td>375</td>
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<tr>
<td>450</td>
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<tr>
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<tr>
<td>825/900</td>
<td>1600</td>
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<tr>
<td>975</td>
<td>1950</td>
</tr>
<tr>
<td>1050</td>
<td>2100</td>
</tr>
</tbody>
</table>
1. PVC pipes adjacent to concrete shall be wrapped with 6mm Denso tape or 250 microns Polyethylene film or equivalent.

2. Bottom of trench to be a stable and approved foundation.
CONCRETE HEADWALLS

Table 1:

<table>
<thead>
<tr>
<th>H (up to)</th>
<th>L (mm)</th>
<th>T (mm)</th>
<th>S (mm)</th>
<th>A, B &amp; C Rods</th>
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<td>2900</td>
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<tr>
<td>3200</td>
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NOTES:

1. Type 1 headwall required if "K" is 200 or less, otherwise type 2 is satisfactory.
2. Concrete shall be 25 MPa 75mm slump.
3. If "W" exceeds the minimum, reinforcing shall correspond to actual width.
4. One yield joint (per SD341) shall be adjacent to the headwall for pipes 900 or less, a second yield joint shall be within 1.3m.
5. For pipes with diameter greater than 1200mm, special design shall apply.
6. Pipe ends shall be plain unless otherwise specified.

Piezo 371
Cut end of pipe at 45° grind back exposed steel 20mm and place bead of epoxy mortar on cut surface.

Scour protection as specified

Boulders to specified diameter set in M/4:AP40

Toppill depth as specified

Compacted M/4:AP40

OUTFALL DETAILS

END VIEW

Scour protection

Haunching metal

Pipe

W.L. - partial submersion

Pipe set in M/4:AP40

Topsoil depth as specified

Boulders to specified diameter set in M/4:AP40

Compacted M/4:AP40

Haunching metal

Pipe

W.L. - partial submersion

Pipe set in M/4:AP40

Compacted M/4:AP40

Haunching metal

Pipe

W.L. - partial submersion

Pipe set in M/4:AP40

Compacted M/4:AP40

Haunching metal

Pipe

W.L. - partial submersion

Pipe set in M/4:AP40

Compacted M/4:AP40

Haunching metal

Pipe

W.L. - partial submersion
150φ TO 750φ PIPES

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<tr>
<td>750</td>
<td>1200</td>
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</tbody>
</table>

NOTES:
1. Concrete to be 25 MPa 75 slump.
2. Steel to be deformed rods to AS/NZS 4671.
3. Beam length shall be specified.
4. For pipes larger than 750mmφ, special design required.
5. First yield joint shall be adjacent to upstream end of beam and second yield joint shall be not more than 1.3m away.
NOTES:

1. Cast iron frames to be seated on cement sand mortar, and set in with plant mix asphalt or mortar as required.

2. Yield joints shall be provided in accordance with plan SD341 except that in all cases two yield joints and one short pipe shall be used.

3. General method of pipelaying, angle connections, corbels, etc, to be in accordance with plan SD341.

4. Concrete work to comply with NZS 3109.

5. All concrete to be 40MPa.
1. Inspection chamber lid as detailed shall not be subject to traffic loading.

2. A standard manhole shall be used when the depth exceeds 900mm.

3. Inspection chambers on drains connected to sanitary sewer shall be positioned so as to avoid the entry of surface water and grit.

4. Bends adjacent to the inspection chamber shall not be greater than 45°.

5. Steel lids shall be hot dip galvanised after fabrication, lids shall be a good fit to avoid rocking or jamming.

6. Notes on sheet SD375 apply.
HILLSIDE INTERCEPTOR DRAIN

INTERCEPTOR DRAIN

Perforated pipe

Impermeable membrane to invert & downhill side of trench

Slope 1 in 6

15 MPa 150 slump concrete full width of trench sloped to pipeline.

CCC filter medium

Perforated pipe

CCC Filter Medium

Trench width

see SD344/sht.2

300 mm. Cover over pipe

300 mm. Cover

200 Topsoil

200 Topsoil

150 slump

SUBSOIL DRAINS

SD377

JUNE 2005
SUBSOIL DRAIN

Trench width
see SD344/sh.2

300 mm Cover

Excavated material
or approved
granular backfill
or topsoil.

Perforated pipe

Geotextile fabric to strength
class A & filtration class 3
TNZ F/7 2000

SWALE SUBSOIL DRAIN

Grade as specified
max. 25%, min. 2%

Width as specified

150 Soil Mix
2 parts topsoil
1 part 2A sand

100 Swale
2A sand

Perforated pipe

CCC Filter Medium

Geotextile fabric to strength
class A & filtration class 3
TNZ F/7 2000

SD377
SUBSOIL DRAINS

Christchurch City Council

ISSUE DATE AUG 2003

SHEET 2 of 3
SUBSOIL DRAIN PIPES

DN100 and DN150

Drill 2 rows each side 8mm dia. holes

DN200, DN225 and DN300

Drill 3 rows each side 8mm dia. holes
**TYPE A**

- All concrete to be 20MPa at 28 days
- All stormwater piping to comply with CSS Part 3

**NOTES:**

1. Use 225 x 125 Inspection box up to 350 depth to invert (lowest pipe),
   Use 300 x 175 Inspection box over 350 depth to invert (lowest pipe) & up to 500 depth,
   Use House drain sump over 500 depth to invert.
### SPINDLE CAP DIMENSIONS

<table>
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<tr>
<th>TYPE</th>
<th>C</th>
<th>D</th>
<th>E</th>
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</thead>
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<tr>
<td>Valve / 50, 80 &amp; 100mm</td>
<td>42</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>Valve / 150, 200, 250 &amp; 300mm</td>
<td>49</td>
<td>32.75</td>
<td>21</td>
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</table>

**NOTES:**
1) Spindle cap to be made from Cast Iron to AS 1830.
2) Spindle cap to be polymeric coated to AS/NZS 4158.
3) Fix to valve shaft with M12 stainless steel set screw.
4) Dimple valve shaft at set screw location to aid fixing.
5) The spindle cap external shape can be circular.

**Top View**

**Side View**

**Section**

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WASTEWATER
SPINDLE CAP

SD382

ISSUE DATE MAR 2013

SHEET 1 OF 1
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CSS: Part 4 2013 a printed 1/04/13
1.0 FOREWORD

This Specification forms Part 4 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General
CSS: Part 2 2013 - Earthworks
CSS: Part 3 2013 - Utility Drainage
CSS: Part 4 2013 - Water Supply
CSS: Part 5 2013 - Lights
CSS: Part 6 2013 - Roads
CSS: Part 7 2013 - Landscapes

Part 4 of the Standard Specification includes those Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

AS/NZS 2032: 2006 Installation of PVC pipe systems
AS/NZS 2033: 2008 Installation of polyethylene pipe systems
AS/NZS 2566.2: 2002 Buried flexible pipelines - Installation
AS/NZS 4158:2003 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4087:2011 Metallic flanges for waterworks purposes
ISO 13953: 2001 Polyethylene (PE) Pipe and Fittings – Determination of the tensile strength of test pieces from a butt-fused joint

National Code for Utility Operators’ Access to Transport Corridors

Christchurch City Council Schedule of Local and Special Conditions to the National Code of Practice for Utility Operator’s Access to Transport Corridors 2013
3.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

Selected materials are specified in CSS: Part 1 - General.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

3.1 Authorised Water Supply Installer

*Each work site shall have an Authorised Water Supply Installer working full time. This person shall carry out all works in accordance with the ‘Conditions for Approval as an Authorised Water Supply Installer’. The individual’s approval shall be removed where they contravene the requirements. Details of the Authorised Water Supply Installer shall be provided in the Contract Quality Plan, as detailed in IDS, clause 3.3 – Project Quality System.*

This person is permitted to control Council water main and submain contracts, fire service connections, new subdivision reticulation works and their connection to the existing system and the connection of new pump stations and reservoirs to the existing system. Reactive maintenance work on the existing system, temporary connections to the system via fire hydrants and new metered water connections are specifically excluded from this agreement.

Details regarding Authorised Water Supply Installers are available at
3.2 Materials

Refer to IDS, clause 7.12 – Materials for Council’s requirements regarding material specifications.

The Contractor shall supply the pipe details where not recorded on or where different from the plan. Materials supplied shall be approved materials as stated above. Refer to IDS clause 12.4 – As-Built Records for those details required with the as-built records.

This information shall be provided through the Contract Quality Plan at Practical Completion, to facilitate the compilation of accurate as-built records of assets installed under these works.

All fittings shall have a pressure rating at least equivalent to the rating of the adjacent pipe. All pipe lengths shall be supplied and stored on site with end caps fitted.

All pipe diameters are nominal internal, unless specifically stated otherwise.

4.0 PREVENTION OF CONTAMINATION OF CHRISTCHURCH’S DRINKING WATER SUPPLY

All work shall comply with the Council’s ‘Conditions for Approval as an Authorised Water Supply Installer, Schedule D – Techniques & procedures for preventing contamination of Christchurch’s potable water supply system’.

Schedule D specifies the following:

- The chain of cleanliness for equipment and fittings prior to use on all works.
- Worker hygiene and the steps necessary to minimise the potential for workers to be a source of contamination.
- Sterilisation procedure prior to the commissioning or re-commissioning of plant.
- Water testing required to establish compliance with Drinking Water Standards of New Zealand (DWSNZ), prior to plant commissioning or re-commissioning.
- Procedures to be followed when contamination of the system has occurred.
- The submitting of a Hygiene Certificate, prior to application for a Certificate of Practical Completion.

The objective of this clause is to:

- comply with the regulatory requirements.
- afford a high level of confidence that when work is carried out on the water supply system, the water supply network is not put at unnecessary risk of contamination.

The Ministry of Health is notified immediately if a water sample taken from the public water supply is found to contravene the Maximum Acceptable Values (MAVs) of the DWSNZ. Contamination could impact severely in the health of consumers, particularly the elderly, infants and people with immune deficiencies.
Where contamination is found, the Council is required to immediately isolate and remove the source of the contamination. Where this contamination is caused by work carried out by a Contractor, this Contractor shall incur the costs of remedial work.

These requirements also apply to work carried out in subdivisions.

4.1 **Hygiene Certificate**

*Before a Certificate of Practical Completion is issued, the Authorised Installer shall complete, sign and return to the Council, as part of the documentation required under the Contract Quality Plan, a Hygiene Certificate confirming that during the period of these works the authorised installer and all people directly involved with the work have adhered to and complied with the provisions of the Authorised Water Installer’s Specification.*

The Hygiene Certificate template shall be the Contractor’s Completion Certificate.

4.2 **Measurement of Works and Basis of Payment**

All costs involved in the prevention of contamination of Christchurch’s water supply shall be borne by the Contractor.

5.0 **HAZARD IDENTIFICATION**

*The Contractor’s Health & Safety Plan must include the means for dealing with all hazards likely to be encountered on the site.*

5.1 **Electrical Earthing of Metallic Waterpipes**

Prior to 1961 it was common practice for metal water supply pipes to be used as the electrical earth for private premises. A change in electrical supply regulation and the use of plastic water supply pipes means that most premises no longer have their electrical earth in this manner. However, a number are still earthed this way and the Contractor shall be aware that cutting and separating metal water pipes may cause a voltage difference (electric shock).

5.2 **Asbestos Cement Pipe**

The health requirements for cutting asbestos cement pipes include:

- All pipe in the vicinity of the cut must be kept wet at all times to avoid dust.
- All slurry/sludge from the dampening down process must be collected and disposed of by burying or some other means to ensure that dust containing asbestos is not generated.
- All equipment used for cutting the pipe must be thoroughly wiped/or washed down and the sludge etc disposed of as above.
• Similarly any clothing or other items, i.e. dust masks, that have come into contact with the cutting fluid must be washed down or disposed of by suitable means to ensure asbestos dust cannot be created in the future.

6.0 INTERFERENCE WITH WATER SUPPLY NETWORK

The Contractor shall not operate valves or fire hydrants or otherwise interfere with the Water Supply Network without the Engineer’s permission.

This is important as headworks operating procedures exist that need to be followed.

7.0 NOTIFICATIONS

7.1 Start Work Pamphlet

The Contractor shall deliver the Start Work Pamphlet to each property affected by the contract works at least 36 hours before work commences.

7.2 ‘Water Shutdown’ Notification

The Contractor shall notify each affected consumer prior to turning off the water supply. The Contractor must obtain approval from the Engineer before shutting off consumers’ supplies.

The Engineer will supply to the Contractor a pro-forma letter, which advises the consumer of work taking place. This letter must be delivered by the Contractor to each affected property prior to 10.00am not less than one and not more than three working days prior to any work commencing that affects those properties (Saturday and Sunday are not counted as working days).

Where it is possible to turn off the water to an individual property without affecting other properties, the Contractor must verbally notify the property owner immediately before the water is turned off. Where this is not possible the letter must give specified times for the shut-off and the Contractor must adhere to these times.

7.3 Shutdown Timing

Any water shut-offs to consumers must be limited to the minimum possible time and carried out without any meal or tea breaks. All consumers, whenever possible, shall be notified of intended shutdowns and of the expected duration.

Water shut-downs shall be arranged between the hours of 9.00 am and 3.00 pm except by prior agreement with the Engineer. Where a daytime water shutdown will disrupt business activities, the Engineer may require the Contractor to re-issue the shutdown notifications for and arrange a night-time shutdown. Shutdowns shall only be granted when the Contractor
has all the plant, equipment, labour and materials necessary for the task on site.

7.4 Contractor’s Representative

The Contractor shall supply to the Engineer the name, address and a 24-hour contact telephone of the Contractor’s Representative. Details of the Contractors Representative shall be provided in the Contract Quality Plan, as detailed in IDS, clause 3.3 – Project Quality System.

The name of this representative shall be supplied before any work is carried out on the contract. This representative must be authorised by the Contractor to act on their behalf and to expeditiously investigate any consumer complaints and repair all such reported downstream plumbing faults.

7.5 Consumer Complaints

The Engineer will assume that any plumbing problems within private premises reported in the three days subsequent to pipe installation work are the responsibility of the Contractor. Should the Contractor’s Representative, on investigation, dispute the liability of the Contractor for the fault in the consumer’s system, the representative should advise the consumer to engage a tradesperson of his/her own choice to carry out repairs, pay the account and forward it, together with a request for reimbursement (giving reasons for his/her belief that it is the Council’s responsibility), to the Engineer within 28 days. The Council will compensate the Contractor for all reasonable costs incurred in investigating consumer complaints that are found not to be their responsibility.

The Engineer shall arbitrate on the liabilities involved and approve Council reimbursement to the consumer. Corresponding deductions will be made from contract payments if the Engineer determines that the consumer’s complaint related to a fault that was the Contractor’s responsibility.

The Engineer reserves the right to make arrangements to have consumer faults repaired expeditiously. The Contractor shall be responsible for any repair costs associated with the work undertaken. In particular, neither the failure of the shift control officer to contact the Contractor’s Representative nor the passing of a period in excess of three days before the complaint is received exonerates the Contractor from the costs of repairs attributed to work undertaken by the Contractor.

7.6 Measurement of Work and Basis of Payment

Payment for the delivery of the start work pamphlet and shutdown letter by the Contractor shall be included in the rate for pipe installation.
8.0 CRITICAL CONSUMERS

The Contractor shall liaise, particularly with critical consumers, regarding the timing and duration of water shutdowns. These may include dialysis patients and healthcare facilities.

8.1 Measurement of Work and Basis of Payment

Where necessary, arrangements for temporary supply may be ordered. This work shall be paid as a variation.

9.0 EXCAVATION

All trenching shall have vertical sides unless otherwise approved by the Engineer. The bottom of the trench shall be flat and conform approximately to grade. At joints a depression shall be cut with ample dimension to allow joints to be made and thoroughly inspected.

Excavations in legal roads shall be carried out in accordance with CSS: Part 1 clause 28.0 - Excavation.

9.1 Length of Open Trench

The Contractor shall not have more than 50 metres of carriageway trench or footpath trench in a commercial area, or 100 metres elsewhere, open in the legal road at any time. When offsite, this open trench shall be reduced to a maximum length of not more than 10 metres.

9.2 Trench Width

The nominal width of trenches for diameters up to and including 150mm shall be 200mm wider than the nominal size of the pipe. Trenches for pipe diameters over 150mm shall be 300mm wider than the nominal size of the pipe. For pipes 63mm and below, where a trench digger may be used, its digging width shall be a minimum of 150mm.

9.3 Keeping the Excavation Free of Water

Subsoil water must be kept down below the bedding.

Should the Contractor fail to take adequate steps to keep the subsoil water down the Engineer shall require other methods to be adopted.

The Contractor shall be responsible for making good any lifting of the pipes due to the flooding of the trench.

9.4 Cover Over Pipes

When laying watermains 100mm and above, the top of the pipe shall have not less than 750mm cover at all times, unless approved by the Engineer.
When laying watermains smaller than 100mm, the following minimum pipe covers shall apply:

- **Metal pipes in carriageways or where likely to be crossed by vehicles**
  - Metal pipes elsewhere: 300mm
- **Plastic or other than metal pipes in carriageways or where likely to be crossed by vehicles**
  - Plastic or other than metal pipes elsewhere: 450mm

The cover over the main shall be increased where necessary to ensure the correct installation of valves and other fittings. The maximum cover shall not exceed 1.5m for watermains 100mm and above and 700mm for watermains smaller than 100mm, unless approved by the Engineer. Similarly depths may require adjustment where crossing other services.

### 9.5 Clearance to Existing Services

New services shall comply with the following clearances (from Table 1 – Utility Clearances of IDS: Part 9 - Utilities), unless approved otherwise by the Engineer.

<table>
<thead>
<tr>
<th>Utility pairing</th>
<th>Clearance (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parallel</td>
</tr>
<tr>
<td>Water – pressure sewer</td>
<td>1500</td>
</tr>
<tr>
<td>Water – gravity sewer</td>
<td>1000</td>
</tr>
<tr>
<td>Water - high voltage power</td>
<td>1000</td>
</tr>
<tr>
<td>Water – s/w, phone, gas</td>
<td>450</td>
</tr>
<tr>
<td>Water - low voltage power</td>
<td>300</td>
</tr>
<tr>
<td>Water submains – sewer, s/w, gas, phone, low</td>
<td>300</td>
</tr>
<tr>
<td>voltage power</td>
<td></td>
</tr>
<tr>
<td>Water submains – high voltage power</td>
<td>300</td>
</tr>
<tr>
<td>Power - sewer, s/w</td>
<td>1000</td>
</tr>
<tr>
<td>Sewer – s/w, phone, gas</td>
<td>1000</td>
</tr>
<tr>
<td>Stormwater – phone, gas</td>
<td>500</td>
</tr>
<tr>
<td>Phone – high voltage power</td>
<td>450</td>
</tr>
<tr>
<td>Phone – low voltage power</td>
<td>300</td>
</tr>
</tbody>
</table>

The Contractor shall notify the Engineer if this clearance will be reduced at any time by the work. Wherever existing pressurised sewer mains cross over watermains the Contractor must notify the Engineer.

### 9.6 Extra Excavation Around Services

Extra excavation shall not apply until the cover of the pipe being laid exceeds 1.0m from the ground surface.

### 9.7 Geotextiles

*Geotextiles shall be installed around the trench backfill in accordance with the manufacturer’s specification, where specified.*
9.8 Measurement of Work and Basis of Payment

9.8.1 Excavation
Excavation shall include sawcutting, excavating to the required depth and nominal width, keeping the excavation free of water, trench support where necessary, removal and suitable disposal of excavated material from site, and all costs incidental to the work. Well pointing is not included in keeping the excavation free of water.

Excavation shall be included in the rate for the relevant scheduled item.

9.8.2 Trench Support
Trench support will only be paid where the Engineer orders its permanent installation. Trench support is measured per m$^2$ on the face area of the trench supported, to the nearest square metre, and includes all materials and any work involved in permanent installation.

9.8.3 Extra Excavation Around Services
Extra Excavation will be paid per m$^3$ solid volume of excavation ordered, to the nearest 0.1 m$^3$, with the quantities being fixed by the depth, width and length of the required excavation.

This rate shall include all items necessary to carry out this work as stated under the scope of excavation above e.g. pumping, trench support.

9.8.4 Unsuitable Foundations
Unsuitable foundations will be paid per m$^3$ solid volume of excavation ordered, to the nearest 0.1 m$^3$, with the quantities being fixed by the depth, width and length of the required excavation.

This rate shall include all items necessary to carry out this work as stated under the scope of excavation above e.g. pumping, trench support.

9.8.5 Geotextiles
Geotextiles shall be included in the rate for the relevant scheduled item. This rate shall allow for laps in accordance with the manufacturer’s specification.

10.0 JOINTING

No jointing shall be permitted under water unless expressly approved.

10.1 Jointing of PVC-u Pipe

Jointing shall be carried out in accordance with AS/NZS 2032 “Installation of PVC pipe systems”, the manufacturer’s instructions and to the Engineer’s satisfaction. Solvent weld joints are not permitted.
10.2 Thermoplastic Jointing of Polyethylene Pipe by Electrofusion Welding

Jointing shall be carried out by approved contractors in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems”, the approved methodology and the pipe manufacturer’s instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 17.2 – Polyethylene Pipe Weld Tests.

Electrofusion couplings are not an acceptable jointing method for sections of PE pipeline that will be pulled into place.

10.2.1 Methodology

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan.

Individual methodologies shall be submitted for each diameter range and material being jointed. The jointing method contained in POP001 “Industry Guidelines for Electrofusion Jointing of PE Pipes and Fittings for Pressure Applications” should form the basis of the methodology.

10.2.2 Quality Assurance Records

The Contractor shall prepare a site welding log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site welding log sheet shall provide the specified and actual fusion and cooling times, ambient conditions and the actual temperature of the pipe and coupler prior to jointing, corresponding to each weld number and certification number. The log shall also clearly identify the location of each joint unless the pipe is installed by trenchless methods.

The completed welding log shall be submitted to the Engineer as an as-built record.

A sample electrofusion welding log sheet is attached in CSS: Part 3 – Utility Drainage Appendix 5.

10.2.3 Operator Qualifications

Electrofusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders hold a NZWETA or EXITO PE Electrofusion Welding Certificate received within the last two years and have proven experience on the pipe diameter range being welded.

A copy of the operator’s qualifications and proof of their experience relevant to the pipe diameter range being welded (e.g. weld test results) shall be submitted through the Contract Quality Plan.

Diameter ranges are up to and including 280mm and over 280mm.
10.2.4 Equipment
Electrofusion jointing shall be carried out using automatic machinery designed for the pipe size. Manually operated welding machines are not acceptable. The machine shall not be changed without the Engineer's approval.

Two clamps supported on a frame shall ensure the alignment of the components and mating of the component ends. Re-rounding clamps of the appropriate size shall be used where necessary.

All equipment shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated regularly. The frequency at which this is carried out will be different for individual items of equipment and will also depend on usage, but should be at least once every 12 months. Guidance should be sought from the equipment manufacturer and a scheme of calibration and servicing implemented.

Particular attention shall be given to the control box, the generator and the peeling tools. The sharpness of the cutter head tools shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves. If they have aluminium facer plates, use a cleaner that will remove aluminium oxide.

Suitable protection against inclement weather shall be provided, to prevent water, dirt and dust contamination and differential cooling of the pipes and couplings. Adequate working space shall be provided around the pipe in the trench to allow peeling and installation of equipment.

10.2.5 Pipe Preparation
The spigot end of the component shall be cut square and all rough edges and swarf shall be removed from the pipe ends.

The maximum ‘out of roundness’ of the pipe shall be 1.5% of the internal diameter. The maximum allowable gap between butted ends within an electrofusion fitting shall comply with the fitting manufacturer’s requirements.

The pipe diameter and wall thickness shall be measured for compliance using the appropriate tools. Sections of the pipe experiencing pipe end reversion shall be removed.

After cleaning pipe ends shall be peeled to 0.3mm depth and for a distance equal to half the length of the coupling plus 20mm to remove dirt and oxidation. This should be peeled to a smooth profile using a sharp rotational peeler. The exposed ends of the pipe strings shall be covered until cooling is complete, to prevent any air flow which may heat or cool the pipe. Covers on fittings shall be retained until immediately before welding.
All jointing surfaces shall be clean, dry and free of all contamination before being assembled. Iso-propyl alcohol complying with the manufacturer’s concentration requirements and a lint-free disposable wipe shall be used to remove any oil or grease films. Mark witness marks with a non-contaminating marker.

The pipe and coupler shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and coupling through the Contract Quality Plan.

10.2.6 Welding
Each electrofusion joint shall be identified with the operator's certification number, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet (refer appendices for an electrofusion log sheet example).

The manufacturer’s recommended Standard Fusion Times (SFT) shall be entered into the control box using the appropriate methods required by the type and model of control box.

- For automated systems, the resistor lead shall be connected to the resistor terminal pin of the coupling.
- For bar code systems, the light pen shall be wiped across the code panel to enter the fusion times.
- For magnetic card systems, the card shall be placed into the control unit reader to enter the fusion times.

The pipe and fittings shall be pre-heated to manufacturer’s requirements if required.

The pipes shall be restrained in position during welding at the centreline height of the coupling, to prevent movement and the application of stress during the fusion process. The pipes shall be horizontal either side of the clamps to prevent both pulling away from the coupling joint and the entry of water or dirt into the pipe, which may contaminate the weld zone.

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

10.2.7 Pipeline Recovery after Pulling in/Cooling of Heated Pipe
The polyethylene pipeline shall be allowed to recover from the effects of thermal expansion and installation stretching. The pipeline shall not be restrained by rigid connections until the pipeline temperature reaches ground or service temperature. Where the pipeline is installed by trenchless methods, a minimum period of 24 hours shall be allowed after installation before connecting the pipe to any rigid connections including previously installed pipelines, bends and valves.
10.3 Site Butt Fusion Jointing of Polyethylene Pipe and Fittings

Jointing shall be carried out by approved contractors in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems”, the approved methodology and the manufacturer’s instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 17.2 – Polyethylene Pipe Weld Tests.

Unless the manufacturer gives explicit permission and provides details of specific welding procedures, butt fusion jointing shall only be used to join pipes and fittings that are:

- composed of similar materials (PE 80 shall be welded to PE 80, PE 100 shall be welded to PE 100);
- the same nominal diameter;
- the same wall thickness measured by Pressure Number (PN) or Standard Dimension Ratio (SDR).

The Contractor shall plan the jointing, installation and tensile testing to minimise the number of electrofusion couplers used.

10.3.1 Methodology

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan. Individual methodologies shall be submitted for each diameter range and pipe material type being jointed.

The methodology shall detail the parameters, as listed in clause 10.3.2 – Quality assurance records, which are necessary to meet the requirements of this specification. It shall also reference the procedures applied to achieve consistent and high quality joints. This methodology shall include (but not necessarily be limited to) the following information:

- the make and model of the butt fusion jointing machine;
- the cylinder area;
- the weld method to be used (e.g. single phase or dual phase);
- the name and qualifications of the approved operator;
- details of the pressure gauge, including the make, dial diameter, pressure range, smallest graduation value and the date of last calibration;
- specific parameters for each nominal pipe diameter, wall thickness and pipe material type to be jointed;

The weld parameters contained in the latest version of POP003 “Industry Guidelines for Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters” should form the basis of the methodology.

CSS: Part 3 – Utility Drainage Appendix 2 provides general requirements for site butt fusion jointing.
10.3.2 Quality Assurance Records
The Contractor shall prepare a site jointing log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site jointing log sheet shall provide the following details:

- Pipeline name/description
- Joint location, accurate enough to locate the joint within one pipe length, unless the pipe is pulled into place.
- Weld date and time
- Operator name and ID number
- Pipe nominal diameter
- Pipe SDR or PN
- Pipe material (PE 80, PE 100)
- Pipe manufacturer's name and pipe identification
- Wall thickness (t, nearest 1 mm)
- Cooled bead height & width (mm)
- Confirmation that the weld parameters have been met (as below).
  - Pipe annular area (A, mm²)
  - Hydraulic cylinder area (a, mm²)
  - Heater plate temperature (°C)
  - Bead-up pressure (P1, kPa)
  - Bead-up time (T1, seconds)
  - Heat soak pressure (P2, kPa) (= drag pressure only)
  - Heat soak time (T2, seconds)
  - Change-over time (T3, seconds)
  - Time to achieve welding pressure (T4, seconds)
  - Welding and cooling pressure (P3, kPa)
  - Cooling time (T5, seconds)

The results shall be presented in tabular form, along with the printouts from the fusion jointing machine.

The completed welding log shall be submitted to the Engineer as an as-built record.

10.3.3 Operator Qualifications
Butt fusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders have a NZWETA or EXITO PE butt fusion welding certificate received within the last two years and have proven experience on the pipe diameter range being welded.

A copy of the operator’s qualifications and proof of their experience relevant to the pipe diameter range being welded (e.g. weld test results) shall be submitted through the Contract Quality Plan.

10.3.4 Equipment
The welder shall have previous experience on the nominated welding machine. The machine shall not be changed without the Engineer’s approval.
The machine shall have either automatic logging facilities incorporated or be retrofitted with suitable logging facilities.

All equipment, but particularly the electrically heated plate, shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated as recommended by the manufacturer. The pressure gauge shall be graduated to be reliably readable to 10 kPa or less and calibrated at least within the last six months.

The heater plate shall be undamaged and temperature controlled to be between 205°C and 235°C over both sides of the whole plate. A portable surface probe pyrometer capable of measuring the plate surface temperature to ±1°C shall be used to confirm this.

The sharpness of the planer or facing tool shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves.

Suitable protection against inclement weather shall be provided, to prevent differential cooling of the pipes and dirt, dust or water contamination e.g. a tent.

Ancillary equipment shall include:
- the clamping device with one fixed and one movable clamp, supported on a rigid frame.
- pipe support rollers or skids.
- pipe end plugs or caps.
- the weld bead measuring gauge.
- iso-propyl alcohol and lint-free disposable wipes.
- a clean ground sheet or baseboard.

10.3.5 Pipe Preparation
The Contractor shall follow the approved welding methodology.

The pipe and fittings shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and fittings through the Contract Quality Plan.

All jointing surfaces, including the heater plate, shall be clean, dry and free of all contamination.

The proposed joint interface shall not show any misalignment of more than 1mm for pipe diameters between 90mm and 315mm and of 2mm for pipe diameters between 355mm and 630mm. The maximum allowable diametric mismatch ("step" in the pipe OD at any proposed butt fusion joint) is 10% of the measured wall thickness.

End gaps between faces to be welded shall not exceed the following values:
### 10.3.6 Welding

Each butt fusion joint shall be identified with the operator's certification number, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet, (refer appendices for a log sheet example).

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

### 10.3.7 Bead Profile

The bead faces shall be smooth and free from pitting bubbles. If pipes are any colour other than black, there shall be no discolouration of the weld bead material.

The joint beads shall be rounded and uniformly sized around the entire pipe circumference. In general, the "V-groove" between the beads should not be deeper than half the bead height above the pipe wall. However, provided that each half of the final bead is of a similar size and shape and tensile testing shows that the strength and failure mode meet the requirements of this specification, the overall width and height of the bead should not be a critical factor in the assessment of a butt fusion joint. Guidelines from POP 003 for the joint bead width are:

<table>
<thead>
<tr>
<th>Minimum Wall Thickness (mm)</th>
<th>Width of Bead (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>9-12</td>
</tr>
<tr>
<td>13</td>
<td>10-14</td>
</tr>
<tr>
<td>16</td>
<td>11-15</td>
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<td>18</td>
<td>12-16</td>
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<td>19</td>
<td>12-18</td>
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<td>22</td>
<td>13-18</td>
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<tr>
<td>24</td>
<td>14-19</td>
</tr>
<tr>
<td>28</td>
<td>15-20</td>
</tr>
<tr>
<td>30</td>
<td>16-22</td>
</tr>
</tbody>
</table>

Neither internal nor external beads shall be removed, unless specified.

### 10.3.8 Joint Failure during Handling and Installation

If a joint fails during handling and installation, the Contractor shall inform the Engineer immediately. The Contractor shall provide the Engineer with the failed joint identification number.
and details of proposed actions to determine if the failed joint is an isolated incident or if it is a symptom of a more widespread problem, through the provision of a Non-Conformance Report.

No further pipe installation shall take place until the corrective action is accepted.

10.4 Measurement of Works and Basis of Payment

Jointing shall be included in the pipe installation rate.

11.0 PIPE INSTALLATION

11.1 Handling

All pipes shall be transported, haunched and installed in accordance with the manufacturer’s instructions. Polyethylene pipe shall be installed in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems” and PVC-u pipe shall be installed in accordance with AS/NZS 2032 “Installation of PVC pipe systems”, except where amended in this specification.

11.2 Cleanliness

Internal pipe walls shall at all times during the Contract be kept clean and free of all dirt, rubbish, water, etc.

If pipes are delivered plugged or capped, they shall remain plugged or capped as long as practical.

11.3 Leaks

The Contractor shall repair all leaks detected up to the end of the defects liability period.

11.4 Pipe Installation by Trenching

11.4.1 Hillside definition

Hillside is defined as any location where either the pipe gradient or surface slope directly uphill or downhill is steeper than 1 in 20 and any location adjacent to hilly areas.

11.4.2 Bedding

Bedding is haunching and surround constructed of imported material placed to the full width of the trench up and around the pipe to the top of the surround.

All metal bedding shall be hand compacted around the pipework without causing unequal loading or damage of any sort. At least 90% of the maximum dry density (MDD) shall be achieved at any point on any bedding.
Nuclear densometer use shall comply with CSS: Part 1 clause 29.5.1 – Compaction testing. The dry density shall be determined in accordance with NZS 4402.4.1.3 “New Zealand vibrating hammer compaction test”.

11.4.3 Bedding Material
The pipe shall be bedded with TNZ M/4:AP20, unless otherwise specified.

11.4.4 Bedding Requirement
Haunching and surround shall be in accordance with SD 410 and the manufacturer’s specifications.

11.4.5 Watermain Location
The pipe shall be installed within 50mm of the specified horizontal offset on straight lines or within 200mm on continuous curves.

11.4.6 Submains
63mm and smaller diameter submains shall be installed at an offset of 150mm ± 50mm from the boundary unless otherwise specified.

The submain pipework shall be connected into existing pipework as specified.

11.5 Polyethylene Pipe Installation by Trenchless Technology

Pipe installation by trenchless technology may be by pipe bursting, sliplining or directional drilling.

Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe. Pipe shall not be bent to a radius less than 35 times the pipe OD.

The load applied to the pipe during pulling shall not exceed the specified allowable load.

Where gouging or notching exceeds the above limits or if buckling of the pipe occurs that length of pipe shall be removed and a new section welded in at the nearest joins.

The Contractor shall overpull an extra metre of pipe for each continuous 200m length of pulled pipe. The excess pipe length shall be supplied to the Engineer for a visual inspection.

11.5.1 Polyethylene Pipe Installation by Slip Lining
The host pipe shall be cleaned to provide a clear pipe diameter that passes the new polyethylene pipe without gouging or notching the pipe.

Disposal of the cleanings shall be carried out in accordance with CSS: Part 1 - General.
The Contractor shall not detrimentally affect the host pipe when cleaning it. The most effective method of cleaning steel pipes in Christchurch is through physical scraping.

Prior to any attempt to pull in the new polyethylene pipe a plug, no less than the diameter of the new pipe, shall be passed through the host pipe to ensure there is sufficient clearance.

11.5.2 Polyethylene Pipe Installation by Directional Drilling

The constructed pipe alignment shall not vary more than 100mm horizontally from the design alignment and the tolerance on the vertical alignment shall not exceed the specified amount.

Cover to pipes of 100mm diameter or greater shall not be less than 750mm, unless approved by the Engineer. Cover to pipes smaller than 100mm in carriageways or where likely to be crossed by vehicles shall be 600mm and elsewhere cover shall be 450mm.

Clearances to services shall be as set out in clause 9.5 – Clearance to Existing Services. The Contractor shall be liable for damages to any underground services.

All liquid waste shall be disposed of in accordance with CSS: Part I - General.

The Contractor shall accurately monitor the position of the drilling head to achieve the above requirements.

11.6 Access Pits

<table>
<thead>
<tr>
<th>Pit Depth</th>
<th>Minimum pit length for pipe diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>110mm</td>
</tr>
<tr>
<td>0.6</td>
<td>3.0</td>
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<tr>
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<td>3.6</td>
<td>6.6</td>
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</tbody>
</table>

Assumptions:

a) New pipe is parallel with the road at the start of the pit and parallel (and in line) with the old pipe at the end of the pit. If this does not apply, calculate the minimum pit length from (b).

b) Table is based on a PE pipe bend radius minimum of 35 times pipe OD.

Pipes shall be haunched through any pits in accordance with clause 11.4 – Pipe Installation by Trenching.
11.7 Measurement of Works and Basis of Payment

Pipe installation shall include shutting off and turning on the water supply during the works.

11.7.1 Pipe Installation by Open Trenching
Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed, including the distance over bends, tees, crosses, thrust blocks etc.

Pipe installation includes excavation as detailed in clause 9.0 - Excavation, installation of all pipework, jointing, installation of in-line fittings and thrust blocks, bedding, backfill and testing. Final surfacing is scheduled separately.

11.7.2 Pipe Installation by Pipe bursting
Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed, including pits and welds. Pipe installation shall include the location of services, pipe bursting, pulling the pipe, haunching and backfilling in pits, provision of samples and testing as detailed in clause 17.0 – Performance testing.

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for one metre only.

11.7.3 Pipe Installation by Slip Lining
Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed, including pits and welds. Pipe installation shall include cleaning the host pipe and checking for clearances, pulling the pipe, haunching and backfilling in pits, provision of samples and testing as detailed in clause 17.0 – Performance Testing.

Special anchor blocks are separately scheduled and shall include all materials and labour.

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for one metre only.

11.7.4 Pipe Installation by Directional Drilling
Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed including pits and welds. Pipe installation shall include determining the alignment, drilling, haunching and backfilling in pits, provision of samples and testing as detailed in clause 17.0 – Performance testing.

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for one metre only.
12.0 FITTINGS

Metal flanges shall comply with AS/NZS 4087:2011 “Metallic flanges for waterworks purposes” and have a flange pressure rating of PN16. Flanges should be raised face flanges. Bolts and washers fitted to metal flanges shall comply with AS/NZS 4087. All carbon steel bolts should be no less than class 8.8 and should be hot dip galvanised.

Washers shall be installed under both nuts and bolt heads. Washers shall be of the same material as the bolt and fitting. Wherever they are different, they shall be isolated from dissimilar materials by inserting nylon washers between the differing surfaces (including where metallic flanges are coated to AS/NZS 4158 “Thermal-bonded polymeric coatings on valves and fittings for water industry purposes”). Washers shall be appropriately sized for the bolt diameter and be a minimum 3mm thickness, increased to 5mm for bolts greater than M24.

Bolt torque shall be between 60-65% of proof stress for the diameter of bolt when tightened, adjusted by the manufacturer’s recommended surface treatment/condition factor for the bolt thread.

Gibault joints and any other exposed metal components shall be thoroughly wrapped in place with a petrolatum impregnated two layer tape system. Mastic filler shall be applied if necessary to fill voids and create a smooth surface for tape application. Primer, filler and tapes shall be applied in strict accordance with the manufacturer’s specifications.

12.1 Valves, Fire Hydrants and Surface Boxes

12.1.1 Valves
The spindles of all valves shall be installed perpendicular to the road surface. Square valve spindle caps complying with SD 420 shall be installed on all spindles. Sluice valve spindle caps shall not be set less than 100mm below the finished level.

The Engineer may require the Contractor to install a pipe sleeve to surround the valve spindle. The sleeve shall extend from the top of the valve up into the valve surface box. The Contractor shall be responsible for ordering the length of the sleeve and installing it so that any incidental loads placed on the valve surface box are not transferred onto the valve itself.

12.1.2 Fire Hydrants
Hydrants shall be installed in line with the main and with valve spindles vertical. The correct sized riser shall be bolted to the hydrant tee to bring the top of the hydrant spindle cap not less than 100mm and not more than 300mm below the finished level.

12.1.3 Surface Boxes
Hydrant and valve surface boxes shall be firmly bedded and accurately positioned on precast concrete frames in accordance with SD 412. The box shall protrude not more than 5mm above the surface and shall lie parallel to the plane of the finished surface.
Hydrant surface boxes shall be positioned so that the long side is parallel to the main.

Precast concrete frames shall be constructed in accordance with SD 405 and CSS: Part 3 clause 12.0 - Structures.

Wood, bricks or in-situ poured concrete shall not be used to make small adjustments in surface level.

12.1.4 Roadmarking
When the section of main has been completed the Contractor shall mark the fire hydrants and sluice valves in accordance with clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves.

12.1.5 Measurement of Works and Basis of Payment
The scheduled rate per item includes excavation and disposal of spoil, bedding, installing valves or fire hydrants, precast thrust blocks, precast concrete frames and surface boxes, backfill and roadmarking. It also includes installing sleeves to valve spindles and risers and blue markers to fire hydrants, where required. Final surfacing is scheduled separately.

12.2 Tees, Crosses, Bends, Tapers

12.2.1 Measurement of Works and Basis of Payment
The scheduled rate per item includes excavation and disposal of spoil, bedding, installing tees, crosses, bends or tapers, precast thrust blocks, and backfill. Final surfacing is scheduled separately.

12.3 Surface Boxes Installed or Adjusted Separately from Watermain Works.

Surface boxes shall be installed or adjusted in accordance with clause 12.1 – Valves, Fire Hydrants and Surface boxes or clause 16.3 – Fittings for Consumer Connections. Restoration shall be as specified below and shall be completed within 48 hours of backfilling within carriageways, Roadmarking shall be carried out in accordance with clause 19.0 – Location marking of fire hydrants and sluice valves.

Restoration outside of existing carriageway surfaces shall comply with the construction requirements of CSS: Part 6 - Roads or Part 2 - Earthworks and Part 7 - Landscapes for that type of work.

Where the surface box shall be installed or adjusted within the carriageway after the surrounding area has been restored, restoration shall be carried out in accordance with the following requirements. These requirements shall also apply where the surface boxes being adjusted are in existing permanent surfacing within the carriageway.

Boxes shall be wrapped in plastic. 200mm width of high slump rapid hardening concrete shall be placed around the box from the compacted base level to within 50mm of the finished surface. The remaining 50mm shall be compacted AC16 or AC10 asphaltic concrete.
12.3.1 Measurement of Works and Basis of Payment
The installation or adjustment of surface boxes includes excavation and disposal of spoil, bedding, installing precast concrete frames and surface boxes, backfill, final surfacing and roadmarking. It also includes installing blue markers to fire hydrants, where required.

12.4 Thrust Blocks

12.4.1 Location
A concrete thrust block shall be located at each bend, tee, etc on all pipes over 50mm internal diameter to the satisfaction of the Engineer.

Generally this shall be at all changes in direction greater than and including 11.25 degrees.

12.4.2 Site Constructed Thrust Blocks
Thrust blocks shall be constructed as designed in the locations specified and shall have a 28 day concrete strength of 17.5 MPa. The concrete must have developed adequate strength and cured for 48 hours before the main is pressure-tested.

Bolts and nuts shall be freely accessible. The pipe shall be wrapped for the length of the thrust block at the concrete interface. Wrapping shall be a compressible material and provide a 6mm installed barrier to the pipe. The wrapping shall prevent gouging of the pipe.

Thrust blocks shall be poured against natural ground. The bearing capacity of the natural or filled ground shall be checked, to ensure it complies with the design capacity, before construction. Proof of this testing shall be provided through the Inspection and Test Schedule in the Contract Quality Plan.

The contact area of the site constructed thrust block will be specified.

12.4.3 Precast Thrust Blocks
Precast thrust blocks shall be constructed in accordance with SD 406 and CSS: Part 3 clause 12.0 - Structures.

Sufficient bracing shall be installed to precast concrete thrust blocks to ensure they do not move when the pipeline is pressurised.

The bearing capacity of the natural or filled ground shall be checked, to ensure it complies with the design capacity, before installation. Proof of this testing shall be provided through the Inspection and Test Schedule in the Contract Quality Plan.

Precast concrete thrust blocks are normally sufficient for 200mm or smaller mains.
12.4.4 Measurement of Works and Basis of Payment
The installation of precast thrust blocks is included in the rate for the fitting to which they apply.

Site constructed thrust blocks are separately scheduled items. These items shall include all materials and labour.

These items shall include for confirming the capacity of the ground on which the thrust block bears through site testing.

12.5 Gradient Anchor Blocks (Vertical Pressure)

*Anchor blocks shall be constructed of 17.5 MPa concrete, to the specified dimensions and in accordance with SD 411.*

The PVC pipe shall be wrapped for the length of the anchor block at the concrete interface. Wrapping shall be a compressible material and provide a 6mm installed barrier to the pipe. The anchor block shall have a drain hole.

The wrapping shall prevent gouging of the pipe under lateral movement. The drain hole shall allow minor groundwater movement.

12.5.1 Location
Gradient anchor blocks shall be positioned behind the pipe collars at the spacings stated below:

<table>
<thead>
<tr>
<th>Gradient</th>
<th>Spacing of anchor blocks in metres</th>
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<tbody>
<tr>
<td>1:2</td>
<td>6</td>
</tr>
<tr>
<td>1:3</td>
<td>6</td>
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<td>1:4</td>
<td>12</td>
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<td>1:5</td>
<td>18</td>
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<tr>
<td>1:6</td>
<td>24</td>
</tr>
</tbody>
</table>

12.5.2 Measurement of Works and Basis of Payment
Gradient anchor blocks include excavation and disposal of spoil, the provision of all materials including pipe wrapping, construction of drain holes and backfill.

12.6 Removal of Redundant Fittings

*Redundant sluice valves and fire hydrants shall be removed. The redundant pipe shall be plugged with concrete. Redundant roadmarking shall be removed in accordance with clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves.*

*The Contractor shall dispose of all removed materials.*

*The disturbed area shall be reconstructed in accordance with clause 13.0 - Backfilling and clause 18.0 – Final Surfacing.*
12.6.1 Measurement of Works and Basis of Payment
Removal of redundant fittings includes excavation and disposal of spoil, removal of fittings, plugging of redundant pipes, return of recycled materials, and disposal of other materials, removal of redundant roadmarking, backfill and final surfacing.

13.0 BACKFILLING

Backfilling shall be in accordance with CSS: Part 1 - General.

13.1 Materials.

Backfill shall be the specified imported material, unless the Engineer approves the use of the excavated material as backfill.

13.2 Treatment of Under-runners

The Contractor shall notify the Engineer of any under-runners, erosion cavities or tunnel gullies encountered during excavation. The Engineer shall advise on under-runner treatment.

The Engineer may order the Contractor to bridge any suspect area with ductile iron pipe. Such work will be paid as a variation to the contract.

13.3 Quality Assurance

The Contractor shall provide records of compliance tests carried out on backfill as required by CSS: Part 1 – General, to comply with IDS: Part 3 - Quality Assurance.

Records of these tests shall be supplied at regular intervals, to provide confirmation of ongoing testing. Details of the proposed methods and frequency of such activities, and the reporting of these, shall be set out in the Contractor’s Contract Quality Plan.

13.4 Measurement of Works and Basis of Payment

13.4.1 Backfill
Backfill includes the supply of materials, placement, compaction and testing. It also includes the provision of testing records.

Backfill to subgrade level under berms and to presealing level elsewhere shall be included in the rates for the scheduled item being backfilled (e.g. pipe installation, fire hydrant). Final surfacing is paid under a separate item, except where detailed in clauses 15.4 and 16.5 – Measurement of Work.

13.4.2 Treatment of Under-runners
The treatment of under-runners will be paid by the solid volume filled, to the nearest m$^3$. This rate shall include any labour and equipment.
The installation of ductile iron pipe, where ordered, will be paid by the lineal metre and shall include all labour and connections.

13.4.3 **Filling to Unsuitable Foundations**
Filling to unsuitable foundations shall be paid per m³ solid volume of fill placed, to the nearest m³, and shall include all work involved as stated under backfill above. Measurement of filling shall be determined from the volume of unsuitable foundations being filled.

### 14.0 CONNECTING INTO EXISTING SYSTEM

*A Water Supply Authorised Installer shall carry out all connections to the existing Council water supply in accordance with the Authorised Water Supply Installer Specification.*

*The Authorised Installer shall ensure that no dirt or debris enters the existing system and that all valves, hydrants to be utilised in the connection/join-in are visible and in operational order.*

Faulty valves and hydrants shall be reported to the Engineer prior to joining in.

14.1 **Measurement of Works and Basis of Payment**

Connecting into the existing system includes excavation and disposal of spoil, the cutting of pipes to facilitate the joining of pipework, the sterilisation of all fittings, materials and equipment required by the Authorised Water Installer’s Specification, all jointing, flushing through fire hydrants and backfill.

Connecting into the existing system shall be included in the rate for pipe installation, where not scheduled separately.

### 15.0 STERILISATION OF NEW MAIN

*Sterilisation and bacteriological testing shall be carried out prior to any consumers being changed over from the existing pipework that is being replaced.*

15.1 **Chlorinating Point**

15.1.1 **Temporary Fitting**
The Contractor shall install a temporary chlorinating fitting, where specified. After sterilisation, the Contractor shall remove the temporary fittings and plug the tapping band.

15.1.2 **Permanent Fitting**
The Contractor shall install the temporary chlorinating fitting to the permanent tapping band and remove after sterilisation.
15.2 Sterilising

The Contractor shall cooperate with the Council’s staff sterilising each section of new main (contact Contract Supervisor phone 941-8325). Sterilisation will take approximately 24 hours for each section.

Sterilisation water shall be either:
- flushed into the sanitary sewer system when the free available chlorine is below 5g/m3,
- removed off site;
- discharged to ground in a manner approved by Council.

15.3 Bacteriological Testing

The Contractor shall cooperate with the Council’s staff taking samples from each section of new sterilised main for bacteriological testing (contact Contract Supervisor phone 941-8325). Bacteriological testing will take approximately 24 hours for each section.

15.4 Measurement of Works and Basis of Payment

The chlorinating point includes excavation and disposal of spoil, installation and removal of temporary fittings, disposal of chlorination water, backfill and final surfacing.

16.0 CONSUMER CONNECTION

Consumer connections shall be installed in accordance with SD 403.

16.1 Connection Position

The connection shall be within 500mm of the legal boundary, in the legal road, common land or the right of way and outside of the driveway construction. The connection shall be relocated if it does not comply with these criteria.

16.2 Changing Consumer Connections to New Pipework

The Contractor shall maintain continuity of supply wherever practical. The Contractor shall take all reasonable precautions to prevent these activities from causing defects to the consumer’s plumbing systems.

16.3 Fittings for Consumer Connections

Existing stopcocks, water meters, combination boxes, etc shall be used wherever possible.
16.3.1 Removal of Existing Stopcocks
Stopcocks shall be replaced if:
- leaking water.
- constructed of plastic.
- not operating.
- backflow prevention is not functioning.

16.3.2 Installation of Stopcock
The stopcock shall be totally free of any spoil. The spindle shall be vertical.

If the existing stop tap only (i.e. a previously unmetered supply) is within private property, the Contractor shall install a new stopcock and meter in the legal road, common land or right of way.

16.3.3 Reuse of Water Meters
The existing water meter shall be reinstalled onto that property’s supply unless the Engineer requires its replacement.

This is vital to ensure integrity of meter records and water consumption data.

Water meters shall be replaced if:
- unreadable.
- not working.
- leaking.
- an old multi-dial type.
- giving inaccurate readings.
- likely to cause future replacement problems through its use.
- backflow prevention is not functioning.

Whenever a meter is not reused at a property, the Contractor shall record the following data on a form similar to that in the appendices ‘Water Meter Exchange: Record Sheet’ and forward the form to the Engineer:
- street address
- serial number of the meter being removed
- serial number of the new meter being installed
- reading of the meter being removed
- date of the meter change

16.3.4 Installation of Water Meter
The meter number and the meter dial shall be readable from directly above.

Care shall be taken to ensure the meter is installed correctly for the direction of flow.

16.3.5 Reuse of Combination Boxes
Boxes, which cannot provide access to both the water meter and stopcock together, shall be removed.
16.3.6  **Installation of Combination Boxes**  
*The stopcock shall operate freely in the combination box and shall not be in contact with the box. The combination box shall be placed flush with the surrounding surface with the longer side parallel to the legal boundary.*

Where there is a likelihood of vehicles driving over boxes, heavy-duty combination boxes shall be used and these shall be installed on precast concrete frames.

16.3.7  **Backfill and Final Surfacing**  
*Backfill and final surfacing shall be in accordance with CSS: Part I - General.*

16.4  **Flushing of Reconnection**

*The Contractor shall open the front outside hose tap, if available, before the supply is reinstated to any premises. Wherever possible, the owner shall be notified prior to this work.*

*The hose tap shall not be closed until the supply runs clear and any debris dislodged by the reconnection work is flushed to waste.*

16.5  **Measurement of Works and Basis of Payment**

Payment shall be per consumer’s connection. The connection shall include excavation and disposal of spoil, installation of all fittings to connect the consumer’s supply to the new pipework, including combination boxes, provision of records as detailed above, flushing, backfill and final surfacing.

Locating and/or shifting the connection into the legal road and any subsequent pipework required shall also be included in the connection. Transport of new and recycled materials and disposal of unfit materials shall be included in this rate.

17.0  **PERFORMANCE TESTING**

*The Contractor shall perform tests as detailed below on all newly installed pipework. The Engineer shall be present at all site tests. 24 hours notice shall be given to the Engineer of all performance testing.*

17.1  **Equipment**

*Gauges used shall have a maximum reading of no more than twice the test pressure. Gauges and meters shall be calibrated at 12-month intervals.*

17.2  **Polyethylene Pipe Weld Tests**

*Welds shall be inspected in the field and assessed in accordance with the requirements of AS/NZS 2033 “Installation of polyethylene pipe systems”.*

Testing shall be carried out in an approved laboratory.
Additional test joints shall be made and tested if there is any change to machine, operator, pipe supplier or PE material.

17.2.1 Pre-construction Joint Testing - Electrofusion

For pipes with nominal diameters 90mm and larger, joints shall be tested in accordance with ISO 13954 Peel decohesion test. For pipe diameters smaller than 90mm, joints shall be tested in accordance with ISO 13955 Crushing decohesion test.

The Contractor shall complete two joints for each pipe diameter and material, using the machine and operator named in the Contract Quality Plan.

Results shall include a commentary on and photos of the failure mechanism, including: peel depth and quality, ovality, gaps and insertion into the coupler, joint alignment, melt flow into cavity. Failed joint samples shall be made available to the Engineer if requested.

The relevant jointing log sheet and a graphical plot of the load versus extension shall be supplied for each test. Ductility shall be evident through the plot showing a rounded top and an extended sloping recession leg. The load-extension graph may be used by the Engineer in assessing the results of the test.

17.2.2 Pre-construction Joint Testing – Butt Fusion

One joint and one section of virgin pipe, for each pipe diameter and material type supplied for the project, shall be tested in accordance with ISO 13953 “Polyethylene (PE) Pipe and Fittings – Determination of the tensile strength and failure mode of test pieces from a butt-fused joint”.

Results shall include a commentary on the failure mechanism. Failed joint samples shall be made available to the Engineer if requested.

The Contractor shall complete the joint using the machine and operator named in the Contract Quality Plan, to demonstrate that the methodology and fusion parameters proposed will produce acceptable fusion joints. The weld bead shall comply with clause 10.3.7 – Bead profile. The relevant jointing log sheet and a graphical plot of the load versus extension shall be supplied for each test. Ductility shall be evident through the plot showing a rounded top and an extended sloping recession leg. The load-extension graph may be used by the Engineer in assessing the results of the test.

The joint must fail at a stress which is greater than 0.9 of the virgin pipe material. Test pieces with a wall thickness < 20 mm shall rupture in a ductile manner.
The cut-out joints shall be of sufficient length to make test pieces that comply with the requirements of ISO 13953 for Type A test specimens. Where the pipe wall thickness > 25 mm, a modified Type A test piece shall be produced by machining a similar amount from each side of the test piece to reduce the wall thickness to 22 mm ±2 mm.

If satisfactory tensile test results cannot be obtained and appropriate ductility of the rupture surface is not illustrated by the load-extension graph and associated photographs, the Contractor shall provide the Engineer with details of the proposed actions to determine the cause of the problem, through the provision of a Non-Conformance Report. No further pipe installation shall take place until the corrective action is accepted.

17.2.3 Joint Testing During Construction – Electrofusion
One site constructed joint shall be tested for each 20 joints constructed for each differing diameter or material, in accordance with clause 17.2.1 – Pre-construction joint testing - electrofusion. Where the length is between 100m and 50m, one joint shall be tested. Lengths less than 50m shall require only pre-construction testing. The Engineer shall select the joints for testing.

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in CSS: Part 3 - Drainage clause 14.5.5 - Joint test failures.

17.2.4 Joint Testing During Construction – Butt Fusion
One joint per pipeline for every 20 joints constructed shall be tested in accordance with clause 17.2.2 – Pre-construction joint testing – butt fusion.

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in CSS: Part 3 - Drainage clause 14.5.5 - Joint test failures.

17.3 Pressure Testing

Pipelines shall be water tested in-situ, to the specified in-ground pressures, when fully haunched and backfilled. Complete the Pipe Pressure Test Checksheets in Appendices XV and XVI of IDS: Part 3 – Quality Assurance, as modified by the Engineer.

The test pressure shall not exceed 1.25 times the rated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.
17.3.1 PVC, Ductile Iron, Glass Reinforced Plastic Pipe
A pressure test shall be carried out in accordance with clause 6.3.4.1 of AS/NZS 2566.2 “Buried flexible pipelines – Installation”.

17.3.2 Polyethylene Pipe (100mm to 315mm diameter)
A pressure test shall be carried out in accordance with clause 6.3.4.4 of AS/NZS 2566.2, as amended by CSS: Part 3 clause 14.3.2 – Polyethylene Pipe up to DN 315.

17.3.3 Polyethylene Pipe (over 315mm diameter)
A pressure test shall be carried out in accordance with clause 6.3.4.2 of AS/NZS 2566.2. A graphical plot of the pressure test shall be supplied to the Engineer with the test readings. Swab the pipeline to remove air before carrying out the pressure test.

17.3.4 Polyethylene Pipe (less than 100mm diameter)
A pressure test shall be carried out in accordance with Appendix M Method 8 of AS/NZS 2566.2.

17.4 Measurement of Works and Basis of Payment

Testing is included in the rate for pipe installation.

17.4.1 Polyethylene Pipe Weld Test
Payment for specified sampling, testing, re-jointing and reinstatement etc of joints shall be for each complying joint. The rate for electrofusion joint testing shall include for all time related effects associated with set up, testing, approval, re-jointing etc.

If additional testing is required due to a change in machine, operator, pipe supplier or material or to prove defective work, the additional tests and any related costs shall be borne by the Contractor.

18.0 FINAL SURFACING

Final surfacing shall be carried out in accordance with CSS: Part 1 - General and the Works Access Permit (WAP) conditions, where applicable.

Apply for a Corridor Access Request (CAR) at www.beforeudig.co.nz.

18.1 Measurement of Works and Basis of Payment

Final surfacing is measured on the lineal metre of pipe installed, to the nearest metre, which shall include final surfacing to any fittings installed on the pipe.

Final surfacing from presealing level includes the supply and placing of all materials and shall also include sawcutting, bandaging where necessary and additional sealing width as detailed in CSS: Part 1 clause 30.0 – Restoration.
and Final Surfacing. The reinstatement of existing roadmarkings shall also be included in this rate.

Final surfacing to berms shall include the supply of topsoil, sowing and establishment of the berm in accordance with CSS: Part 2 – Earthworks and CSS: Part 7 – Landscapes.

19.0 LOCATION MARKING OF FIRE HYDRANTS AND SLUICE VALVES

19.1 Roadmarking

*Fire hydrant marking shall be completed within 24 hours of the final surfacing. All other roadmarking shall be completed within 48 hours of the completion of the final surfacing except where the surface is chipseal where roadmarking shall be completed within 24 hours of carriageway sweeping. The carriageway shall be swept within 72 hours of the completion of chipsealing.*

*Paint shall be applied in accordance with the requirements of CSS: Part 6 - Roads.*

*Hydrant marker posts shall be removed and disposed of.*

19.2 Fire Hydrants

*Painting of fire hydrant surface boxes, triangles and circles shall be in accordance with SD 404.*

Fire hydrant surface boxes shall be painted yellow. A yellow triangle shall be painted on the fire hydrant side of the centreline of the carriageway, directly opposite to and pointing at the fire hydrant. A yellow circle shall be painted around a fire hydrant only when a fire hydrant will regularly have vehicles parking adjacent to it.

A bi-directional blue reflectorised raised pavement marker shall be installed adjacent to the yellow triangle within the following roads: within the four Avenues surrounding the central city; Riccarton Road; Papanui Road; Main North Road (from Papanui Road to Cranford Street); Harewood Road (from Main North Road to Breens Road).

19.3 Sluice Valves

*Shut valve surface boxes shall be painted red. Anti-clockwise opening butterfly valve surface boxes shall be painted yellow. All other sluice valve surface boxes shall be painted white. Valve marking shall be in accordance with SD 404.*

A white triangle shall be painted on the top of the kerb directly opposite the valve, pointing at the valve.
19.4 **Paints and Markers**

*Only approved paints and markers shall be used.*

19.5 **Removal of Redundant Markings**

*Redundant markings shall be removed in accordance with the requirements of CSS: Part 6 - Roads.*

19.6 **Measurement of Works and Basis of Payment**

Roadmarking is included in the rate for the installation or adjustment of the fitting being marked. The removal of the roadmarking associated with a fitting being removed or made redundant shall be included in the rate for the removal or disconnection of that fitting.

Where the fitting exists, roadmarking shall be paid per item.

20.0 **AS-BUILT RECORDS**

Capital Programme Group (phone 941-8704) now undertakes the GPS location of all water services, on behalf of the Council.

The Contractor shall ensure that sufficient opportunities are given to Capital Programme Group staff to obtain sufficient measurements to prepare as-built information to an acceptable level of accuracy. IT Services Unit requirements are that:

- All pickup shall be to an accuracy of ±100mm.
- As-built pipe materials and pipe sizes shall be noted on the plan.
- All surface boxes shall be accurately located either by GPS or by ties to legal boundary pegs.
- Watermain and submain alignments shall be located by reference to surface boxes or boundary pegs or by offsets from boundaries.

Capital Programme Group requires 24 hours notice that works are ready for pickup and 24 hours to carry out that pickup. The Contractor may take accurate measurements of works that require immediate backfill, providing such measurements are taken to the requirements set out in IDS: Part 12 – As-Built Records and presented to Capital Programme Group in a form such that they can provide complete and accurate records.

20.1 **Measurement of Works and Basis of Payment**

There will be no additional payment for the provision of as-built records.
CITY WATER AND WASTE UNIT

WATER METER EXCHANGE RECORD SHEET

Undertaken in conjunction with job: __________________________

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>METER ON</th>
<th>METER OFF</th>
<th>REASON FOR EXCHANGE</th>
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<tbody>
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<td>Serial No.</td>
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CSS: Part 4 2013  printed 1/04/13
### BUTT PIPE WELD LOG SHEET

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<th>T4 Sec</th>
<th>P3 kPa</th>
<th>T5 Sec</th>
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**ELECTROFUSION PIPE WELD LOG SHEET**

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<th>Fitting Details*</th>
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<th>Pipe Batch</th>
<th>O %</th>
<th>D mm</th>
<th>RF Sec</th>
<th>RC Sec</th>
<th>AF Sec</th>
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*Details = manufacturer, barcode number*
# COMPLIANCE REQUIREMENTS CHECKSHEET – WATER SUPPLY

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<th>CSS REF</th>
<th>TASK</th>
<th>TEST STD/ DESCRIP</th>
<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
<th>ACTIONS</th>
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<td>Trench Depth</td>
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<td>Fittings and materials</td>
<td>AS/NZS 2032, manuf reqs</td>
<td>Diameters match, materials compatible and correct</td>
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<td>Pt 4 10.1</td>
<td>Jointing</td>
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<td>Inspect completed joint</td>
<td>AS/NZS 2032, manuf reqs</td>
<td>All fittings snug and firm, no movement or leakage</td>
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<td>POP001</td>
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<td>Manufacturer confirmed compatibility; witness mark location; fitting/pipe gap</td>
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<td>Pt 4 10.2.6</td>
<td>Pipe preparation</td>
<td>Measure, manuf reqs, POP001</td>
<td>‘Out of roundness’ less than 1.5%, end gaps, pipe dimensions comply, pipes cleaned and protected, witness marks, pipe insertion</td>
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<td>Correct parameters, pipe position, visual inspection satisfactory, weld marked, fusion times complied with, welding records kept</td>
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<td>ISO 13954, ISO 13955</td>
<td>All test results received, acted on</td>
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<td>Approved supplier and materials compatible and correct</td>
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<td>Pt 4 10.3.4</td>
<td>Equipment</td>
<td>AS/NZS 2033, manuf reqs</td>
<td>Equipment clean, appropriate, plate temperature constant and as specified, re-rounding clamps, specified cleaners.</td>
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<td>Pt 4 10.3.5</td>
<td>Pipe preparation</td>
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<td>End alignment and end gaps comply, pipes cleaned and protected, ends protected, air temperature above 4°C</td>
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<td>Welding</td>
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<td>Welding records kept, weld marked, visual inspection satisfactory</td>
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### 6 PIPE INSTALLATION BY TRENCHING

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<td>Watermain alignment</td>
<td>measure</td>
<td>± 50mm of design on straights or ± 200mm on curves</td>
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<td>Pt 4 11.4.6</td>
<td>Submain offset</td>
<td>measure</td>
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<td>Pt 4 11.5</td>
<td>Pipe installation by pulling</td>
<td>AS/NZS 2033, manuf reqs</td>
<td>Load does not exceed that specified. Gouging, notching under 10% wall thickness for pressure pipe</td>
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<td>Vertical alignment by directional drilling</td>
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<td>750mm cover + 100mm pipe</td>
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<td>Pt 4 9.5</td>
<td>Clearance to Existing Services</td>
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<td>Pt 4 11.5.2</td>
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<td>± 100mm of design</td>
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<td>Access pits</td>
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<td>Exceed 3.4m length</td>
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<td>Hydrant in line with main.</td>
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<td>Fire hydrant installation</td>
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<td>Spindle vertical and cap between 100mm-300mm below finished surface</td>
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<td>Surface box installation</td>
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<td>Within 5mm of and parallel to finished surface, complies with SD 412</td>
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<td>On precast frames. Frames to SD 405.</td>
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<td>Thrust block installation</td>
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<td>Thrust block installation</td>
<td>SD 406</td>
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<td>Gradient anchor installation</td>
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<td>Pt 4</td>
<td>Fitting removal</td>
<td>inspect</td>
<td>Roadmarking removed, pipe plugged</td>
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<td>measure</td>
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<td>TNZ M/10</td>
<td>Complies with specification</td>
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<td>Asphaltic concrete supply – AC 7</td>
<td>TNZ M/10</td>
<td>Complies with specification</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>Pt 6</td>
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</tr>
<tr>
<td>Pt 2</td>
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<td>Finished surface shape - berm</td>
<td>measure</td>
<td>+10mm, -0mm of existing level</td>
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<tr>
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<td>Chipsealed surface shape - road</td>
<td>measure</td>
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<td>Roadmarking</td>
<td>SD 404</td>
<td>Within 24 hrs for fire hydrants and 48 hrs for rest</td>
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<tr>
<td>14</td>
<td></td>
<td><strong>AS BUILTS</strong></td>
<td></td>
<td></td>
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<td>Pt 2</td>
<td>7.10</td>
<td>Provide Operations Manual</td>
<td></td>
<td>Ensure manual covers all components of irrigation system</td>
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CSS: Part 4 2013 printed 1/04/13
<table>
<thead>
<tr>
<th>ITEM</th>
<th>CSS REF</th>
<th>TASK</th>
<th>TEST STD/ DECRIP</th>
<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
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<td>Sterilisation of water main</td>
<td>contact</td>
<td>Council sterilises main prior to connection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td></td>
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<td>Bacteriological testing</td>
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<td></td>
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<td>15.3</td>
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<td>present</td>
<td>Conditions of Approval as an Authorised Water Supply Installer</td>
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<tr>
<td></td>
<td>4.1</td>
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</tr>
</tbody>
</table>
1. 100mm diameter mains shall have 32mm diameter tapped holes.

2. All larger mains shall have 50mm diameter tapped holes.

NOTES:
2. Gate valve shall be located outside hydrant frame.

NOTES:

1. All backfill in accordance with CSS Part 1.
2. Gate valve shall be located outside hydrant frame.
NOTE:
1. Where there are up to 4 connections off the right of way the connections are to be installed within legal road at the road boundary.

COMMON LAND CONNECTION POSITION
Not to Scale

Meter box to be centrally placed over meter and stop cock.

15mmØ meter to be installed by CCC at a later date

70mm min. 250mm max.

1. Connection box to be heavy duty if instructed.
2. Connection box to be placed on precast concrete frames where located in driveways.
3. Backfill to be in accordance with CSS: Part 1.
4. "Point of Supply" is at the road boundary.

NOTES:
COVER AND CIRCLE MARKING

TRIANGLE MARKING
(Adjacent to centreline)

HYDRANT MARKINGS
Not to Scale

SLUICE VALVE MARKINGS
Not to Scale

NOTES:
1. Hydrants to be marked with yellow approved roadmarking paint.
2. Hydrant circle marking required in parking areas only.
3. Sluice valves to be marked with white approved roadmarking paint.
4. Shut valves to be marked with red approved roadmarking paint.
5. Anti-clockwise opening butterfly valves to be marked with yellow approved roadmarking paint.
NOTES:
1. Reinforcing shall be placed centrally in frame (at optimal cover).
2. Concrete shall be 30MPa at 28 days.
3. Concrete finish shall be FC or better.
1. Concrete shall be 30MPa at 28 days.
2. Construction to comply with CSS: part 3: clause 12.
3. Concrete finish shall be U3.
Ground Level

Approved Backfill

<table>
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<th>Nominal Pipe Diameter</th>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>&lt; 150</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>≥ 150 &lt; 300</td>
<td>150</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>
NOTES:

1) Concrete to be 17.5MPa 150mm slump unreinforced.

2) PVC pipes adjacent to concrete shall be wrapped with 6mm Denso tape or 250 micron polyethylene film or equivalent.
1) All backfill in accordance with CSS Part 1.

2) Where valve is for wastewater reticulation, fit triangular spindle cap on top of square spindle cap and maintain the same clearance to valve cover.
NOTES:

1) Spindle cap to be made from Cast Iron to AS 1830.
2) Spindle cap to be polymeric coated to AS/NZS 4158.
3) Fix to valve shaft with M12 stainless steel set screw.
4) Dimple valve shaft at set screw location to aid fixing.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve / 50, 80 &amp; 100mm</td>
<td>34</td>
<td>62</td>
<td>42</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>Valve / 150, 200, 250 &amp; 300mm</td>
<td>35</td>
<td>62</td>
<td>49</td>
<td>32.75</td>
<td>21</td>
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APPENDICES

1 Road Lighting Valuation – Removed Equipment
2 Road Lighting Valuation – New Equipment
3 Road Lighting Valuation – Pole and Arm Codes
4 Compliance Requirements Checksheet

STANDARD DETAILS

Streetlights
SD 501 Typical streetlight installation underground supply
SD 502 Typical streetlight installation low voltage distribution pole
SD 503 Typical streetlight installation HV/LV distribution pole – type 1
SD 504 Typical streetlight installation HV/LV distribution pole – type 2

Fuse Panels
SD 510 Road lighting pole fuse panel connection details
SD 511 Road lighting pole fuse panel new subcircuit connection details
SD 512 Road lighting pole fuse panel 3 phase connection details
SD 513 detail deleted Revision 7.0
1.0 FOREWORD

This Specification forms Part 5 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General
CSS: Part 2 2013 - Earthworks
CSS: Part 3 2013 - Utility Drainage
CSS: Part 4 2013 - Water Supply
CSS: Part 5 2013 - Lights
CSS: Part 6 2013 - Roads
CSS: Part 7 2013 - Landscapes

Part 5 of the Standard Specification includes those Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

NZS 3910: 2003 Conditions of contract for building and civil engineering construction
AS/NZS 1158.0: 2005 and Amdt 1-2005 Road lighting - Introduction
AS/NZS 1158.1.1: 2005 and Amdt 1-2005 Road lighting - Vehicular traffic (Category V) lighting - Performance and design requirements
AS/NZS 1158.1.3: 1997 Road lighting - Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance
AS/NZS 1158.3.1: 2005 and Amdt 1-2005 Road lighting - Pedestrian area (Category P) lighting - Performance and design requirements
AS/NZS 1158.6: 2010 Road lighting – Lighting for roads and public spaces - Luminaires
3.0 SCOPE OF WORK

This specification sets out the requirements for the installation of lighting for legal roads, service lanes, cycleways and pedestrian accessways where these lights will be administered by the Christchurch City Council, as part of the electricity operator’s streetlighting network.

The requirements for cabling and supply within legal road are not included, as these shall be constructed to the Electricity Network Operator’s requirements. Where cabling will be vested and is outside of the legal road, it shall be constructed to the same standards as the adjacent electricity network.

4.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, EQUIPMENT, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

Unless otherwise specified, all construction materials and permanently installed equipment shall be new. Selected materials are specified in CSS: Part 1 - General.

Tenderers may offer alternative or recycled materials or equipment from that scheduled, provided that the Engineer has approved the alternatives prior to tendering.
Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

5.0 EXISTING SERVICES AND TREES

All work in the vicinity of existing services or trees shall be carried out in accordance with CSS: Part 1 - General.

6.0 HAZARD IDENTIFICATION

The Contractor’s Health & Safety Plan must include the means for dealing with all hazards likely to be encountered on the site.

6.1 Polychlorinated Biphenyls (PCBs)

Best attempts have been made to remove Polychlorinated Biphenyls (PCBs) from the streetlighting system however the Contractor should be aware of the possible presence of equipment containing PCBs. Any equipment suspected of containing PCBs must be handled in accordance with the “Ministry of Health Code of Practice for Safe Management of PCBs”.

If any equipment is found that contains (or is suspected to contain) PCBs, the Engineer shall be notified immediately. Equipment suspected of containing PCB's should be returned to the Council’s Street Lighting Maintenance Contractor, for removal of PCB’s, before disposal.

7.0 EXCAVATION

All excavations shall be carried out in accordance with the requirements of CSS: Part 1 - General and the Electricity Operator.

7.1 Excavations in Legal Road

Excavations carried out in legal roads shall be carried out in accordance with CSS: Part 1, clause 28.0 - Excavation.

Where the Engineer has not obtained a Network Works Access Permit for the works, the Contractor shall apply for a Corridor Access Request (CAR) at www.beforeudig.co.nz and forward it to the Council.

7.2 Excavations Within and Adjacent to Private Property

All work in private property shall be carried out in accordance with CSS: Part 1 - General.
The Contractor shall provide adequate support to the excavation when working in close proximity to the road boundary to prevent any damage or subsidence into the excavation. Any subsidence or damage shall be remedied immediately to the property owner’s satisfaction at the Contractor’s cost.

7.3 **Measurement of Work and Basis of Payment**

Excavation shall include sawcutting and excavating to the required depth and width, trench support where necessary, removal and suitable disposal of excavated material from site, and all costs incidental to the work.

Excavation shall be included in the rate for the relevant scheduled item.

8.0 **INSTALLATION**

*All works, materials and equipment shall comply with the Electricity Act, the Electricity (Safety) Regulations, the Radiocommunications (Radio) Regulations, AS/NZS 3000 Electrical installations, the Electricity Network Operator’s requirements and any other relevant regulation, standard or code of practice.*

All cabling and supply work shall be carried out to the Electricity Network Operator’s requirements, including where the cabling will not be taken over by the electricity network operator.

8.1 **Installation of Standards and Arms**

*All poles and arms shall be assembled, lifted and installed to the manufacturer’s specifications and recommendations and in accordance with SD 501, SD 502, SD 503 or SD 504. All metal poles arms and brackets shall be hot dipped galvanised. Paint poles for a length from 100mm above the ground level mark to 400mm below it with an approved protective coating.*

Holes shall not be excavated until the Engineer has approved the marked location. The Engineer may amend the specified location on site.

The pole shall be installed within 0.1m of the approved marked location, unless a tighter tolerance is specified. Poles shall be firmly installed at the specified height above final ground level to ±50mm of the manufacturer’s ground level. Poles shall be within 1° of vertical.

For overhead supply, the light fitting’s optical centre in the installation shall be within 400mm of the specified vertical location. For underground supply, the height, measured from the manufacturer’s ground level mark to the optical centre of the light fitting, shall be within 200mm of the specified height.
Where flange mounted poles, excluding slip based poles, are used the flange and holding down bolts shall be covered.

The base compartment door of the pole shall face towards the adjacent footpath.

Poles installed shall be frangible where setbacks for rigid poles do not comply with the requirements of IDS, clause 11.4.10 – Pole setback from road or path.

Where poles are to be installed against the boundary line, the Contractor shall ensure that the poles are installed in the legal road and that no aerial trespass occurs.

8.2 Luminaires

Luminaires shall be manufactured, tested and certified in accordance with AS/NZS 1158.6 Road lighting – Lighting for roads and public spaces - Luminaires. Housings shall have an ingress protection rating of a standard appropriate to the requirements of the luminaire or control gear.

Unless otherwise specified, lamps shall be high-pressure sodium. They shall be either tubular or elliptical as specified, to match the luminaire optical system. The luminaires shall have control gear in the head, installed to the manufacturer’s recommendations. Lamps shall be compatible with this control gear and comply with all relevant codes.

The luminaire control gear housing shall also include a Metway fuse terminal block FTB1 or a ‘Safeclip’ type SC 32/H front wired 32 amp, 415 volt fuse carrier with an appropriately rated HRC fuse link.

Control gear shall be complete with an approved multi pulse superimposed ignitor (details can be found at the following web address - www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx). The ignitor shall be matched to the control gear and lamps.

8.3 Panels and Terminations

Panels and terminations shall comply with SD 510, SD 511 and SD 512 and. the Electricity Operator’s requirements.

8.4 Internal Wiring

Tough plastic sheathed cable (TPS), 1.5mm² copper twin and earth shall be used to connect between the fuse panel and each lamp fitting and shall be continuous without joints.
8.5 Measurement of Work and Basis of Payment

Installation shall include excavation and disposal of spoil, completion procedures and certification, commissioning, backfilling and restoration. Installation shall be paid by lump sum or per light installed, as specified.

Cable shall include supply, excavation and disposal of spoil, installation, backfilling and restoration and shall be paid by lump sum.

9.0 COMPLETION PROCEDURES AND CERTIFICATION

Certification, testing and commissioning shall be carried out in accordance with the Electricity Act, the Electricity (Safety) Regulations, AS/NZS 3000, any other relevant regulation, standard or code of practice and the Electricity Network Operator’s requirements for connecting to their network. Documentation of this shall be provided through the Contract Quality Plan.

All lighting shall be inspected and the Certificate of Compliance, (including the inspection section), completed and returned to the Engineer. The Contractor’s Completion Certificate shall also be completed and returned (see Appendix VIII of IDS: Part 3 - Quality Assurance). The Contractor shall provide all test certificates, showing that each luminaire and associated equipment meets the requirements of this specification and the relevant Electricity Regulations, standards and codes of practice.

The Contractor shall provide records of all removed assets and all newly installed assets to the Engineer/Engineer’s Representative. The forms ‘Road Lighting Valuation – Removed Equipment’ and ‘Road Lighting Valuation – New Equipment’ can be used to provide this information (see appendices). ‘Road Lighting Valuation – Pole and Arm Codes’ set out in the appendix shall be used when completing these forms.

The Contractor shall compile field-generated as-builts. Where the work is within the road boundary, the as-builts shall show the location of lighting equipment in relation to the legal boundary. Where work is outside the legal road, the as-builts shall include the location of lighting equipment including cables, to the requirements of the relevant Electricity Operator.

Non-complying installations must not be commissioned.

9.1 Measurement of Work and Basis of Payment

Completion procedures and certification shall include all tests, certification and inspection necessary to fulfil the requirements of this clause.
10.0 COMMISSIONING

The existing lighting must be kept operating until the new lighting is commissioned. New and existing lighting shall not operate simultaneously. If it is necessary, for construction purposes, to remove the existing lighting prior to commissioning the Contractor shall provide temporary lighting. Temporary lighting shall comply with AS/NZS 1158.1.1 “Road lighting” or AS/NZS 1158.3.1 for that lighting category and shall be approved by the Engineer.

The Contractor must be present when commissioning is carried out.

Where the lighting is to be commissioned in stages, it shall begin at one end and continue through to the other end. When staging commissioning, it is crucial that hazard situations are not created (e.g. by stopping the commissioning prior to an intersection).

Lights may only be commissioned after all test and compliance certificates have been received and approved by the Engineer. Where it is necessary to stage the livening of an installation, individual lights may be commissioned after the Engineer has received the ‘Test Certificate’ and a ‘Contractor’s Completion Certificate’ for that light. The compliance certificate and a final ‘Contractor’s Completion Certificate’ for the complete works shall be received and approved by the Engineer when all lights are commissioned.

The works shall not be considered complete, in accordance with NZS 3910 “Conditions of contract for building and civil engineering construction” until commissioned and all completion certification is received.

10.1 Measurement of Work and Basis of Payment

Commissioning shall include the provision of temporary lighting, where required.
11.0 BACKFILLING

Backfilling shall be carried out in accordance with CSS: Part 1 - General.

11.1 Materials.

*Poles shall be backfilled with CCC SAP 40, unless otherwise specified.*

*Backfill to trenches shall be the specified imported material, unless the Engineer approves the use of the excavated material as backfill.*

11.2 Quality Assurance

*The Contractor shall provide records of compliance tests carried out on backfill as required by CSS: Part 1 - General.*

Records of these tests shall be supplied at regular intervals, to provide confirmation of ongoing testing. Details of the proposed methods and frequency of such activities, and the reporting of these, shall typically be set out in the Contractor’s Contract Quality Plan.

11.3 Measurement of Works and Basis of Payment

Backfill to subgrade level shall include the supply of materials, placement, compaction and testing. It shall also include the provision of records of backfill testing.

12.0 DEFECTS LIABILITY

The following criteria shall be met at the end of the defects liability period:

- all poles and arms shall be assembled, lifted and installed to the manufacturer’s specifications and recommendations.
- poles shall be at the specified height above final ground level to ±50mm of the manufacturer’s ground level.
- poles shall be within 1° of vertical.
- the pole shall be within 0.1m of the approved location, unless a tighter tolerance is specified.
- the light fitting’s optical centre shall be within 400mm of the vertical location in the group for overhead supply or within 200mm for underground supply.

Minor lighting failures and defects within the defects liability period shall be rectified within 24 hours of reported failure unless otherwise specified. Failure to respond may result in the Engineer making arrangements to have the work done by others at the Contractor’s cost.

The Council’s Maintenance Contractor will repair equipment damaged by vandalism or motor vehicle accidents.
13.0 SURPLUS MATERIALS

13.1 Return of Surplus Materials

*All road lighting fittings and equipment are the property of the Christchurch City Council. All recycled materials, owned by the Council but not specifically required for this contract, shall be returned to the Council. The Engineer shall specify which fittings are suitable for recycling.*

Any damage done to these fittings by the Contractor shall be made good at the Contractor’s expense.

The Contractor shall return recycled materials to Council’s streetlighting maintenance contractor (currently Connetics) within normal working hours.

13.2 Disposal of Unfit Materials

*The Contractor shall dispose of all materials the Engineer has verified as unfit for recycling.*

13.3 Measurement of Works and Basis of Payment

Transport of new unused or recycled materials or disposal of unfit materials shall be included in the rates for the replacement items being constructed.

14.0 RESTORATION

*Restoration shall be carried out in accordance with CSS: Part 1 - General and the Network Works Access Permit (WAP) conditions where applicable.*

14.1 Measurement of Works and Basis of Payment

Restoration from subgrade level shall include additional sawcutting where necessary and additional sealing width as detailed in CSS: Part 1, clause 30.0 – Restoration and Final Surfacing.

Restoration shall be included in the rate for the relevant scheduled item.
## ROAD LIGHTING VALUATION – NEW EQUIPMENT

**Date:**

**Contractor:**

**Location:**

**Order/Contractor Number:**

**Drawing Number:**

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### Other (provide details):

Removal of Existing Equipment

* Values include both materials and installation costs.
** Material (cable) cost only.
***Excluding Orion Contribution.
Date: 
Contractor: 
Location: 
Order/Contractor Number: 

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<td>S3</td>
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## COMPLIANCE REQUIREMENTS CHECKSHEET - LIGHTING

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<td>Complies with AS/NZS 3000, and regs</td>
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<td>High pressure sodium, match optical system, compatible with control gear</td>
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<td>Control gear in head, approved material, housing includes specified fuse</td>
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3 COMPLETION

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4 COMMISSIONING

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<td>Adequate lighting available over whole site.</td>
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5 BACKFILLING

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<td>Complies with grading</td>
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<td></td>
<td></td>
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<tr>
<td>Pt 5</td>
<td>11.2</td>
<td>Compaction of backfill</td>
<td>Clegg hammer</td>
<td>35 in road, ROW or commercial crossing, 25 elsewhere</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pt 5</td>
<td>11.2</td>
<td>Compaction of backfill</td>
<td>MDD by ND</td>
<td>2150kg/m² in road, ROW, commercial crossing or path, 70% elsewhere</td>
<td></td>
<td></td>
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<tr>
<td>Pt 6</td>
<td>6.5</td>
<td>Presealing surface shape - path</td>
<td>measure</td>
<td>Max 10mm gap, cumulative total gap under 25mm</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pt 1</td>
<td>28.1</td>
<td>Subgrade surface shape - berm</td>
<td>measure</td>
<td>75mm below existing surface</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pt 6</td>
<td>11.4</td>
<td>Presealing surface shape - road</td>
<td>measure</td>
<td>Max 12mm gap, cumulative total gap under 25mm in both directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
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### 7 SURPLUS MATERIALS

| Pt 5 | 13.0 | Surplus materials | inspect | Recycled materials returned to council, unfit materials disposed of |

### 8 RESTORATION

<p>| Pt 1 | 28.1 | Surface preparation | inspect | Sawcut edges in permanent surfaces, strip to fender where within 1.5m |
| Pt 1 | 30.1 | Asphaltic concrete supply – AC 5 | TNZ M/10 | Complies with specification |
| Pt 1 | 30.2 | Asphaltic concrete supply – AC 7 | TNZ M/10 | Complies with specification |
| Pt 6 | 6.6  | Tackcoat application | inspect | Tackcoat adheres to complete surface |
| Pt 6 | 6.7  | Asphaltic concrete laying | measure | Air voids between 2.5% and 11% Mix temperature within 10° of delivery temperature |
| Pt 6 | 6.8  | Sealed surface shape - path | measure | Max 5mm gap, cumulative total gap under 20mm for longitudinal 3m straightedge and under 10mm for transverse 1m |</p>
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<th>TASK</th>
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<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
<th>ACTIONS</th>
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<td>Pt 2</td>
<td>9.5.2</td>
<td>Finished surface shape - berm</td>
<td>measure</td>
<td>+10mm, -0mm of existing level</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>14.4</td>
<td>Chipsealed surface shape - road</td>
<td>measure</td>
<td>Surface to be convex, mate-ins to be flush</td>
<td></td>
<td></td>
<td></td>
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<td>measure</td>
<td>Max 5mm gap, cumulative total gap under 10mm for longitudinal 3m straightedge</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>inspect</td>
<td>Bandage AC edges, overlap chipseal</td>
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Notes
1. Offset for roadways without a kerb, is taken from the white edge line.
2. Base compartment door is to face the adjacent footpath. Door is to be secured with 6mm (or 8mm) allen key setscrews. Setscrew threads to be coated with longlife anticorrosive grease.
Luminaire as Specified

Outreach as Specified

Tilt

Outreach Arm as Specified

Installation on Crossarm if required

M16 Bolt, Locknut and Washer

Mounting Height as Specified

L.V. Crossarm

L.V. Distribution Pole

Typical STREET LIGHT INSTALLATION

ISSUE DATE DEC 2009

SD502 SHEET 1

Christchurch City Council
1. Outreach arm to be mounted on front or back of pole depending on location of centre insulator.

2. Replace the existing 11kV cross arm with a 2.3m 33kV cross arm to allow for the clearances specified in note 4.

3. Guard hook to be fitted to centre insulator at a suitable position so as to achieve a min. clearance of 350mm between the guard hook and the outreach arm and a min. clearance of 210mm between the guard hook and centre insulator.

4. The position of the outreach arm can be varied (up or down) to achieve a different mounting height for the luminaire providing the distance between the internal bend of the outreach arm and the top of the pole is not less than 600mm.

5. 25 x 25 x 4 flat earthing lug, with 8# hole, welded to outreach arm in approx. position shown. Earthing conductor to be (min.) 15mm² Cu PVC (Green insulation)
Notes

1. Replace the existing 11kV cross arm with a 3.0m x 0.1m x 0.1m cross arm to allow for the clearances specified in note 2. This arm to have the same drilling arrangement as the standard 2.0m cross arm.

2. Guard hook to be fitted to outside insulator in a suitable position so as to achieve a min. clearance of 300mm between the guard hook and the outreach arm and a min. clearance of 210mm between the guard hook and outside insulator.

3. 25 x 25 x 4 flat earthing lug, with 80 hole, welded to outreach arm in approx. position shown. Earthing conductor to be (min.) 16mm² Cu PVC (Green insulation)
**NOTES**

1. Fuse panel to be secured to inside of pole opposite door opening. Secure with suitable size nut and spacer behind panel. For concrete poles use 25mm mounting hole. For steel poles use 40mm mounting hole.

2. Suitable sized hole to be mounted adjacent to fuse.

3. For installations where only one SLN cable is to be terminated, the phase conductor can be terminated directly into the fuse carrier, eliminating the need for a line connection and 4mm² phase conductor.

4. The SLN cable neutrals are to be secured onto the Neutral Stud with their own nut. Independently of the other neutral connection, the TPS neutral and Earth-neutral link to be established last so that any future removal of these will not result in the SLN cable neutrals being disconnected.

5. Earth and Neutral Studs to be made up from M6 x 50 Brass screws, nuts and washers. Refer to Note 4 for the specific requirements of the Neutral Stud connections.

6. For concrete poles and steel poles that are painted or have a door gasket around the opening provide a 6mm² Cu PVC Green earth conductor from Earth Stud to be bonded to the door with a screw, bolt, nut and lock nut. M6 x 50 must be removed from the earthing connection area.

7. Ownership details are as follows:
   - Orion - SLN cables including the tap and 4mm² phase conductor to bottom of the Main Fuse.
   - CCC - Everything other than above.

8. All Orion owned equipment (SLN cables, line taps etc) shown are typical only. Refer to Orion's standards and specifications for specific requirements, in particular Network Operating Standards NW 2172 01.

---

**TYPICAL INSTALLATION ASSEMBLY**

**DETAIL 'A'** MATERIAL: Green Formica P1, or similar electromechanical grade laminate
**NOTES**

1. Two new fuse holders are to be installed onto existing fuse panel as shown. The lower left fuse becomes the Main Fuse and the other two fuses become the subcircuit fuses which feed the light and new load (bus shelter). The size of the subcircuit fuse links to be determined by the Engineer prior to installation.

2. Suitable labels are to be mounted adjacent to each fuse identifying its function. Refer to Label Schedule.

3. The new subcircuit cable shall be a suitable size twin + NS (or 3 core) cable. The new subcircuit cable shall be connected into the bottom of each subcircuit fuse. The neutral and earth conductors to be connected to the neutral and earth studs as shown.

4. The existing phase conductor is to be terminated into the top of the Main Fuse and two 4mm² Cu PVC phase conductors are to be connected from the other side of the Main Fuse into the bottom of each respective subcircuit fuse as shown. The existing phase conductor feeding the light is to be reconnected into the appropriate fuse holder as shown.

5. Ownership details are as follows:
   - Orion - SLN cables including line tap and 4mm² phase conductor feeding the bus shelter.
   - CCC - Everything other than above.

6. All Orion owned equipment (SLN cables) are shown as typical only. Refer to Orion's standards and specifications for specific requirements. All network operating standards and specifications for specific requirements will be in the Network Operating Standards NW 217 02/04.

**LABEL SCHEDULE**

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<tr>
<td>1</td>
<td>MAIN</td>
</tr>
<tr>
<td>2</td>
<td>LIGHTS</td>
</tr>
<tr>
<td>3</td>
<td>SAT FUNCTION</td>
</tr>
</tbody>
</table>

**DETAILED MATERIAL LIST**

- Formica P1 or similar

**DIMENSIONS**

All dimensions in millimetres unless otherwise stated.

---

**ROAD LIGHTING POLE**

**FUSE PANEL - NEW SUBCIRCUIT CONNECTION DETAILS**

**SD511**

**ISSUE DATE**: AUG 2003
TYPICAL INSTALLATION ASSEMBLY

TYPICAL THREE PHASE CABLE TERMINATION DETAILS

NOTES
1. Fuse panel to be secured to inside of pole, opposite door opening. Secure with suitable screws nut and spacer bolted panel. For concrete poles use #8 mounting hole. For steel poles use #8 mounting hole.

2. Suitable label to be mounted adjacent to fuse, adjacent to fuse panel, and adjacent to fuse panel.

3. For conduction where only one SLN cable is to be terminated, the phase conductor can be terminated directly into the fuse carrier eliminating the need for a line tap connection and 4mm² phase conductor.

4. The SLN cable neutrals are to be secured onto the Neutral Stud with their own nuts independantly of the other neutral connections. The Neutral Stud is insulated and all neutrals able to be installed last so that any future removal of these will not result in the SLN cable neutrals being disconnected.

5. Earth and Neutral Studs to be made up from M6 x 50 Brass Screws, nuts and washers. Suitable label to be mounted adjacent to fuse panel.

6. All Orion owned equipment (SLN cables, line taps etc) shown are typical only. Refer to Orion’s standards and specifications for specific requirements, in particular Network Operating Standard NW 21 72 01.

7. Ownership details are as follows:

8. Orion owned equipment (SLN cables) cables the type and shown are typical only. Refer to Orion’s standards and specifications for specific requirements, in particular Network Operating Standard NW 21 72 01.

9. CCC - Everything other than above.

10. All dimensions in millimetres unless otherwise stated.

ROAD LIGHTING POLE
FUSE PANEL - 3 PHASE
CONNECTION DETAILS

SD512
ISSUE DATE AUG 2003
SHEET 1
CHRISTCHURCH CITY COUNCIL

CONSTRUCTION STANDARD SPECIFICATION

PART 6 – ROADS

CSS: PART 6 2013

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1 Compliance Requirements Checksheet

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1.0 FOREWORD

This Specification forms Part 6 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General
CSS: Part 2 2013 - Earthworks
CSS: Part 3 2013 - Utility Drainage
CSS: Part 4 2013 - Water Supply
CSS: Part 5 2013 - Lights
CSS: Part 6 2013 - Roads
CSS: Part 7 2013 - Landscapes

Part 6 of the Standard Specification includes those Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

NZS 3109: 1997 Concrete construction
NZS 3114: 1987 Specification for concrete surface finishes
NZS 3116: 2002 Concrete segmental paving
NZS 4407: 1991 Methods of sampling and testing road aggregates
NZS 5414: 1977 Specification for the construction of traffic signs
AS/NZS 1428.4: 2009 Design for access and mobility - Tactile indicators
AS/NZS 4586: 2004 Slip resistance classification of new pedestrian surface materials
AS/NZS 4455.2: 2010 Masonry units, pavers, flags and segmental retaining wall units – Pavers and flags
AS/NZS 4456: 2003 Masonry units, segmental pavers and flags - Methods of test
3.0  APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:


Selected materials are specified in CSS: Part 1 - General. CCC AC5, CCC AC7 and CCC SAP20 shall not be used within the carriageway. TNZ M/4:AP20 shall not be used within the carriageway except as a running course in accordance with TNZ B/2.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.
4.0 CONCRETE KERBS AND CHANNELS, MEDIAN KERBS ETC

4.1 Scope of Work

This specification is for the construction of concrete kerbs and channels.

Refer to standard details SD 601-606, SD 611-614 or plans for dimensions.

4.2 Excavation and Foundations

Existing surfaces shall be sawcut at the limits of excavation if they are not to be reconstructed following the construction of the concrete kerbs and channels etc. Existing kerbs to remain shall be sawcut to 50mm depth on all exposed faces.

Set out pegs shall not be damaged or disturbed.

Foundations shall be hard, unyielding, free from debris and of uniform bearing. Unsuitable foundation material shall be removed to meet design requirements. Filling shall be compacted to a minimum dry density of 2,100 kg/m³ and 75% of readings shall equal or exceed 2,150 kg/m³.

No tolerance on the subgrade level that reduces the depth of the concrete kerb and channel etc will be allowed.

The Engineer will require the Contractor to confirm that the subgrade achieves the design CBR prior to pouring of concrete.

4.3 Concrete Construction

All concrete and work shall comply with CSS: Part 3 clause 12.0 - Structures, unless specified below. In-situ concrete strength shall be at least 20 MPa at 28 days. Cast in-situ concrete shall have a slump of 75mm.

All concrete shall be compacted in place.

Contraction joints shall be formed at the interface between the existing and new kerb and channel.

Concrete finish shall conform to Class U3 of NZS 3114 “Specification for concrete surface finishes”, and all concrete shall be a uniform colour. This includes repairs to damaged concrete and concrete core holes.

4.4 Contraction Joints

Contraction joints shall be installed in new kerbs and channels at approximately 5m spacings with a maximum of 6m.

Contraction joints shall be guillotined a minimum depth of 50mm on all exposed faces and on the front face of the channel. The vertical surfaces
of the kerb and channel shall not be deformed i.e. the moulded kerb profile shall not alter. The joints shall be left exposed without any slurry trowelled over them.

Joints shall be formed each side of a cut down at the thinnest point and on one side of stormwater outlet pipes where the pipe surround is poured continuously with the kerb (on the edge of the pipe).

4.5 Acceptance Criteria

Kerb and channel dimensions shall comply with the specified dimensions with a tolerance of ±5mm.

Channels with a design gradient of 1 in 500 or steeper shall not pond water. The finished level shall be within ±5mm of design.

The line of the kerb shall be straight between tangent points and shall sweep around curves without kinks, flats, or angles in a smooth arc. The maximum deviation from a 3m straight-edge laid along the kerb face shall be 5mm with a cumulative total of all visible gaps of not more than 10mm. The position of the kerbs and channels etc shall be within 10mm of design.

4.6 Stormwater Outlets to Kerb and Channel

Only approved kerb entry adaptors shall be used.

Stormwater outlets through the kerb shall be provided at all existing property drains and where ordered by the Engineer, except where the pipe is directed to the underchannel pipe.

The kerb entry adaptor shall be installed in conjunction with the pouring of the kerb and channel. The invert of the adaptor shall be level with invert of channel.

4.7 Testing

4.7.1 Metalcourses under the Kerb and Channel
Densities shall be measured by Nuclear Densometer.

4.7.2 Kerb and Channel
Cores shall be taken at the positions as determined by the Engineer. The cores shall be greater than 90mm in diameter and shall be tested for compressive strength by an approved laboratory. The cores shall be clearly marked to identify the contract site and core location. The coring and testing shall be in accordance with NZS 3109 “Concrete construction”.

For machine laid kerb and channel each core shall be assumed to represent the truckload of concrete for that pour.
A copy of the test results shall be sent directly to the Engineer from the testing laboratory.

4.8 Measurement of Works and Basis of Payment

4.8.1 Breakout and Disposal
Payment for breakout and disposal of existing kerb and channel, culvert crossings, sumps and stormwater pipes shall be by lump sum to the limits shown on the plans. The rate shall include excavation, disposal and the recovery of reusable items, where specified.

4.8.2 Sawcutting
Saw cutting along the edge of the excavation when the existing path and/or carriageway is not to be reconstructed, shall be per metre, to the nearest 0.2m. Rates are provided for depths in increments of 50mm.

Excavation beyond the limits prescribed shall be made good at the Contractor’s expense.

4.8.3 Unsuitable Foundations
The excavation of unsuitable foundations shall be paid per m$^3$ solid volume of excavation agreed, to the nearest m$^3$, including disposal.

Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

4.8.4 Filling
Filling of the excavated unsuitable foundation shall be paid per m$^3$ solid volume, to the nearest m$^3$, and shall include for the supply, transport, placing, compaction and trimming of the material.

Measurement of fill shall be by measuring the excavation or by using the agreed dimensions.

4.8.5 Kerb and Channel
Kerb and channel shall be paid per lineal metre, to the nearest 0.2m. Kerbs and channels shall be measured along the face of the kerb and shall be measured continuously, without deduction at sumps or vehicle crossings (pedestrian, residential or commercial).

Kerb and channel shall include excavation and disposal of spoil, metalcourses under the kerb and channel and their testing, filling behind the kerb, formwork, pumping, contraction joints and curing.

This rate shall also include sweeping the kerb and channel at six weekly intervals over the Defects Liability period.
Backfilling behind the kerb shall be to the subgrade of the proposed path, berm or landscaped area, or if mating in to an existing path, berm or landscaped area, to the existing levels.

4.8.6 Extra Concrete Base and Reinforcement
Extra concrete base shall be paid per lineal metre, to the nearest 0.2m and shall include excavation and disposal of spoil, formwork, concrete and reinforcing, if ordered.

4.8.7 Vehicle (Residential and Commercial) and Pedestrian Cutdowns
Vehicle cutdowns shall be paid per lineal metre, to the nearest 0.2m. The rate is extra over the rate for kerb and channel and shall include all costs in forming the cutdowns in the kerbs and in finishing.

4.8.8 Commercial Crossing Beams
Commercial crossing beams shall be paid per lineal metre, to the nearest 0.2m. The rate shall include all work including excavation and disposal of spoil, formwork, reinforcing, concrete.

4.8.9 Stormwater Outlets
Payment shall be for the number installed and the rate shall include all work involved including the supply of the kerb entry adaptor.

4.8.10 Testing
Testing of foundation metals is included in the rate for kerbs and channels.

Payment for testing of concrete cores shall be for the number of ordered tests that show compliance with the specification.

5.0 KERB AND CHANNEL REPAIRS

5.1 Scope of Work
This specification is for repairs to existing kerbs and channels or kerbs including vehicle and pedestrian crossings and stormwater outlets.

5.2 Materials

All concrete and formwork shall comply with clause 4.0 - Concrete Kerbs and Channels, Median Kerbs etc. All asphaltic concrete used to reinstate paths and carriageways adjacent to the repairs shall comply with clause 6.0 - Asphaltic Concrete Paths, Vehicle Crossings and Cycleways. All concrete used to reinstate paths adjacent to the repairs shall comply with clause 7.0 - Concrete Paths and Vehicle Crossings.
5.3 Excavation and Foundations

Areas to be repaired shall be as defined by the specification or marked on the site by the Engineer. All edges, including concrete, shall be sawcut prior to excavation. Sawcut concrete shall have a good bond with the new concrete.

All TNZ M/4:AP40 or CCC SAP40 backfill used in the reinstatement shall be compacted to the following minimum Clegg Impact Values: footpaths and residential crossings - 25, commercial crossings and carriageways - 35.

5.4 Kerb and Channel or Kerb Only Repairs

Repaired kerb and channel shall be constructed to an even grade between the existing kerb and channel, or to the levels provided. Repaired kerb and channel lengths greater than 10m shall be poured using a kerb machine. Repaired channel areas and reinstated sealed areas shall nowhere hold water. The finished profile of the repaired concrete shall match the existing kerb and channel.

Reinstatement of adjacent sealed areas shall consist of TNZ M/4:AP40 and AC16 in carriageways and TNZ M/4:AP40 and TNZ M/10:AC10, CCC AC7 or CCC AC5 outside of the carriageway. Reinstatement of adjacent interlocking concrete block pavers, berm or landscape areas shall consist of materials and finish to match the existing construction in accordance with the requirements for that particular type of work.

5.5 Installation of Vehicle and Pedestrian Crossings in Existing Kerb and Flat Channel

All work shall comply with SD 611 or SD 613. Construction on the footpath side of the vehicle or pedestrian crossing shall be in accordance with SD 607 or SD 608 and shall comply with clause 6.0 - Asphalitic Concrete Paths, Vehicle Crossings and Cycleways or clause 7.0 - Concrete Paths and Vehicle Crossings. Reinstatement on the carriageway side of commercial crossings shall consist of TNZ M/4:AP40 and AC16 and shall not extend more than 300mm into the carriageway.

The cut down channel shall be constructed to an even grade between the existing kerb and channel. The crossing or the reinstatement shall not hold water at any point.

5.6 Installation of Vehicle and Pedestrian Crossings in Kerb and Dish Channel

All work shall comply with SD 612. Construction on the footpath side shall be in accordance with SD 607.

An asphalitic concrete ramp shall be constructed on the carriageway side. This ramp shall give a smooth transition through the crossing and shall not cause vehicles to scrape. It shall also give a smooth transition along
the carriageway. The ramp shall not extend into any traffic lane without the Engineer’s approval.

The flow of stormwater in the channel shall not be inhibited.

5.7 Removal of Existing Dish Channel Crossings

Crossing blocks shall be removed without damage to the existing kerb and dish channel and all surplus material shall be cleaned from the existing kerb and dish channel.

The existing ramp shall be removed and reinstated to typical carriageway levels with 50mm of AC16. Edges shall be sawcut prior to the removal of the existing ramp.

5.8 Reinstatement of Cutdown Kerb to Full Height Kerb

The kerb portion shall be removed in accordance with SD 611. The finished profile of the repaired concrete shall match the existing kerb.

Reinstatement of the footpath shall be in accordance with SD 607 or SD 608 and shall comply with clause 6.0 - Asphaletic Concrete Paths, Vehicle Crossings and Cycleways or clause 7.0 - Concrete Paths and Vehicle Crossings. Reinstatement of the interlocking concrete block paving shall match the existing construction and be in accordance with clause 10 - Interlocking Concrete Block, Cobblestone Paving and Tactile Pavers. Reinstatement of the berm or landscape areas shall match the existing construction and be in accordance with CSS: Part 2 - Earthworks and CSS: Part 7 - Landscapes.

5.9 Installation of New Stormwater Outlets in Existing Kerbs

Only approved kerb entry adaptors shall be used. The kerb entry adaptor shall be mortared in place and the concrete cover shall match that over existing outlets.

The pipe between the kerb entry and the road boundary shall comply with CSS: Part 3 – Utility Drainage.

All paths, berms and landscape areas shall be reinstated to the relevant requirements of this specification.

5.10 Repairs to Existing Stormwater Outlets Through the Kerb

A clear path for stormwater shall be provided to the channel.

Only approved kerb entry adaptors shall be used. The kerb entry adaptor shall be mortared in place and the concrete cover shall match that over existing outlets. The line of the repair shall match the existing kerb face and top.
5.11 Measurement of Work and Basis of Payment

5.11.1 Kerb and Channel or Kerb Only Repairs
Kerb only or kerb and channel repairs shall be per metre to the nearest 0.2m. The measurement shall be taken along the face of the kerb and shall be taken right through, without deduction at sumps.

The rate shall include sawcutting, breaking out and disposal, bonding of concrete where sawcut, metalcourses, construction of the new kerb or kerb and channel and reinstatement in front of and behind the kerb.

5.11.2 Crossings in Existing Kerb and Flat Channel
Pedestrian and residential vehicle crossings shall be paid per metre to the nearest 0.2m.

Payment for commercial crossings shall be per metre to the nearest 0.2m of reinforced concrete beam installed.

The rate shall include sawcutting, breaking out and disposal, metalcourses, bonding of concrete where sawcut, construction of new cutdown (including reinforced concrete beam in commercial crossings) and reinstatement of the carriageway.

The construction of the footpath or crossing is paid as defined in clause 9.0 – Repairs and Resurfacing of Footpaths, Vehicle Crossings and Cycleways.

5.11.3 Residential Vehicle and Pedestrian Crossings in Kerb and Dish Channel
Crossings shall be per metre installed, in increments of 0.5m.

Crossings shall include the supply, and installation of kerb blocks and the asphaltic concrete ramp. The rate shall allow for a ramp up to 1m wide over the length of the crossing. Approved ramps wider than 1m shall be paid as a variation.

The construction of the footpath or crossing is paid as defined in clause 9.0 – Repairs and Resurfacing of Footpaths, Vehicle Crossings and Cycleways.

5.11.4 Commercial Vehicle Crossings in Kerb and Dish Channel
Payment shall be per metre to the nearest 0.2m.

The rate shall include sawcutting, breaking out and disposal of all surplus material, metalcourses, bonding of concrete where sawcut, construction of the new crossing including the PVC pipe and reinforcement and reinstatement on the carriageway side including the AC ramp.
The construction of the crossing is paid as defined in clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways.

5.11.5 Removal of Existing Dish Channel Crossing
Removal shall be per metre, to the nearest 0.2m and the rate shall include the removal of the ramp and the reinstatement of the shoulder. The rate shall allow for a maximum reinstatement width of 1.5m. Widths greater than this shall be paid as a variation.

The construction of the grass berm is paid as defined in CSS: Part 7 - Landscapes.

5.11.6 Reinstatement of Cutdown Kerb to Full Height Kerb
Reinstatement shall be per metre, to the nearest 0.2m and the rate shall include sawcutting the kerb.

The construction of the footpath is paid as defined in clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways. The construction of the grass berm is paid as defined in CSS: Part 7 - Landscapes.

5.11.7 Installation of New Stormwater Outlets in Existing Kerbs
Kerb entry adaptors shall be paid for the number installed. The rate shall include sawcutting, bonding of sawcut concrete, the supply and installation of the kerb entry adaptor and the reinstatement of the kerb.

The installation of the pipe between the kerb entry adaptor and the boundary shall be paid per metre. The rate shall include sawcutting, the supply and installation of the pipe, backfilling and reinstatement of the path and/or berm.

5.11.8 Repairs to Existing Stormwater Outlets Through the Kerb
Payment shall be for the actual number repaired. The rate shall include sawcutting, bonding of sawcut concrete, the supply and installation of the kerb entry adaptor, reinstatement of the kerb and footpath or grass berm and cleaning the pipe.
6.0 ASPHALTIC CONCRETE PATHS, VEHICLE CROSSINGS AND CYCLEWAYS

6.1 Scope of Work

This specification is for the construction of asphaltic concrete paths, vehicle crossings and cycleways, as detailed on the standard drawings.

Refer to standard details SD 606-607 or plans for dimensions.

6.2 Excavation and Foundations

*Existing paths, driveways and cycleways shall be sawcut at the limits of work.*

*Foundations shall be hard, unyielding, free from debris and of uniform bearing. Unsuitable foundation material shall be removed to meet design requirements.*

*No tolerance on the subgrade level that reduces the depth of construction will be allowed.*

The Engineer will require the Contractor to confirm that the subgrade achieves the design CBR prior to the placing of the metalcourses.

6.3 Battens

*Battens and pegs shall comply with SD 607.*

*The finished level of the battens shall be ±10mm of design provided the path crossfall is in the designed direction. The position of the batten shall be ±10mm of design. Pegs shall be at least 5mm below the finished batten level.*

*The line of the batten shall be straight between tangent points with the maximum deviation from a 3m straight-edge laid along the batten face of 5mm with a cumulative total of all visible gaps of not more than 15mm and shall sweep around curves without kinks, flats, or angles in a smooth arc.*

*Battens shall be installed perpendicular to the kerb for at least a 300mm length.*

6.4 Weed Control

*Subgrade and metalcourse shall be treated with a soil sterilant containing dichlobenil, e.g. Prefix-D, to prevent re-growth of weeds for a period of 12 months.*

6.5 Metalcourse

*Materials shall comply with CSS: Part 1 - General.*
The compacted surface shall be finished not less than 15mm (25mm for commercial crossings) below the top of batten and not less than 15mm (25mm for commercial crossings) below the top of kerb and at no other point less than 20mm (30mm for commercial crossings) below the finished level.

The gap under a 3m straight-edge placed in any direction shall not exceed 10mm with a cumulative total of all visible gaps of not more than 25mm.

At no point on the surface shall the Clegg Impact Value be less than 25 for footpaths and residential crossings, and 35 for commercial vehicle crossings.

Compaction may be measured by Clegg hammer or other approved impact device. These devices shall be calibrated at 12-month intervals.

6.6 Tack coat

Prior to the application of the tack coat the surface of the compacted metalcourse shall be free of surface water, clean, free from dust, sand, grit, or any other material that could impair the adhesion of the asphaltic concrete.

The tack coat shall be a bitumen emulsion complying with TNZ M/1 and shall be applied uniformly over entire surface at a minimum application rate of 0.25 l/m². There shall be no overspray.

6.7 Asphaltic Concrete

Asphaltic concrete shall comply with CSS: Part 1 - General. It shall be uniform and dense in texture and shall have air voids not less than 2.5% and not more than 11.0% when laid and compacted.

All tests should achieve these criteria. However, if there are suitable construction records confirmed or audited by the Engineer that prove a better result is not achievable, the work will be accepted as meeting the performance criteria.

The compacted depth of the mix shall be not less than 20mm for footpaths, residential vehicle crossings and cycleways and not less than 30mm for commercial vehicle crossings. No tolerance that reduces these depths will be accepted.

All construction joints shall be at right angles to the kerb or batten and shall be butt jointed and tack coated.

6.8 Acceptance Criteria

The finished surface shall be 5mm above kerbs, pavement edge treatments and battens and shall nowhere hold water. The gap under a 3m straight-
edge placed longitudinally shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm for cycleways and 20mm otherwise and the gap under a 1m straight-edge placed transversely shall not exceed 5mm with a cumulative total of all visible gaps of not more than 7mm for cycleways and 10mm otherwise.

If requested, the Contractor shall supply weighbridge dockets, or verifiable summary, which show the date and time loaded, contract number, mix type, temperature and net weight and truck identification.

### 6.9 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

### 6.10 Traffic Signs

All regulatory traffic signs shall be reinstated prior to the removal of the traffic management. All information signs shall be reinstated as soon as practicable. All traffic signs shall be reinstated in terms of clause 24.0 - Traffic Signs.

### 6.11 Completion

The site shall be clean and tidy on completion of work with all surplus material removed.

### 6.12 Measurement of Work and Basis of Payment

#### 6.12.1 Path Construction

Paths shall be paid per m² constructed to the nearest m². The rate shall include sawcutting, excavation and disposal of spoil, battens, weed control, metalcourses, tack coat, asphaltic concrete and adjustment of surface boxes not scheduled separately.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

#### 6.12.2 Vehicle Crossing Construction (residential and commercial)

Vehicle crossings shall be paid per m² constructed to the nearest m². The rate shall include excavation and disposal of spoil, battens, weed control, metalcourses, tack coat, asphaltic concrete and adjustment of surface boxes not scheduled separately.
As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

6.12.3 **Cycleway Construction**
Cycleway crossings shall be paid per m² constructed to the nearest m². The rate shall include excavation and disposal of spoil, battens, weed control, metalcourses, tack coat, asphaltic concrete and adjustment of surface boxes not scheduled separately.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

6.12.4 **Bituminous Material Removal**
The scarification and removal of bituminous material shall be paid per m³, to the nearest m³, and shall include removal of seal and disposal of spoil.

6.12.5 **Unsuitable Foundations**
The excavation of unsuitable foundations shall be paid per m³ solid volume of excavation agreed, to the nearest m³, including disposal.

Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

6.12.6 **Filling**
Filling of the excavated unsuitable foundation shall be paid per m³ solid volume, to the nearest m³, and shall include for the supply, transport, placing, compaction and trimming of the material.

Measurement of fill shall be determined from the volume of unsuitable foundations being filled.

6.12.7 **Surface Boxes**
The adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing stormwater inspection openings, and traffic signal loop toby boxes shall be included in the rate for path, vehicle crossing or cycleway construction.

Payment for the adjustment of stormwater and sewerage manhole tops shall allow for all work involved.

6.12.8 **Traffic Signs**
Payment for the relocation of traffic signs shall be by lump sum or per sign relocated as specified.
7.0 CONCRETE PATHS AND VEHICLE CROSSINGS

7.1 Scope of Work

This specification is for the construction of concrete paths and residential vehicle crossings, as detailed on the standard drawings.

Refer to standard details SD 608 or plans for dimensions.

7.2 Excavation and Foundations

Existing paths and driveways shall be sawcut at the limits of work.

Foundations shall be hard, unyielding, free from debris and of uniform bearing. Unsuitable foundation material shall be removed to meet design requirements.

Materials shall comply with CSS: Part 1 - General.

No tolerance on the subgrade level that reduces the depth of construction will be allowed.

The Engineer will require the Contractor to confirm that the subgrade achieves the design CBR prior to the placing of the metalcourses.

7.3 Formwork

Formwork shall comply with the requirements of NZS 3109 “Concrete construction” as amplified below.

The finished level of the formwork shall be within ±10mm of design provided the path crossfall is in the designed direction. The position of the formwork shall be within 10mm of design.

The line of the formwork shall be straight between tangent points with the maximum deviation from a 3m straight-edge laid along the face of 5mm with a cumulative total of all visible gaps of not more than 10mm and shall sweep curves around without kinks, flats, or angles in a smooth arc.

All formwork shall be removed before backfilling.

7.4 Concrete Materials

Unless otherwise specified, concrete shall be Normal Grade ready mixed concrete, with a slump of 50mm and an in-situ concrete strength of at least 20 MPa at 28 days. The maximum size of coarse aggregate shall be 20mm except when otherwise specified.

Commercial crossing materials shall be as specified.
7.5 Concrete Construction

Concrete construction shall be in accordance with NZS 3109 “Concrete construction”. The concrete finish shall be U5 in accordance with NZS 3114 “Specification for concrete surface finishes” and shall be constructed with the path crossfall.

Concrete depth shall be not less than 100mm for footpaths and 150mm for residential vehicle crossings. No tolerance that reduces these depths will be accepted.

Contraction joints shall be created within 24 hours of concrete laying. Joints shall be at a maximum of 3m centres and at right angles to the kerb.

If requested, the Contractor shall supply a certificate showing the strength, slump and mix reference of the concrete and the time at which the concrete was mixed.

7.6 Acceptance Criteria

The finished surface shall nowhere hold water. The gap under a 3m straight-edge placed longitudinally shall not exceed 5mm with a cumulative total of all visible gaps of not more than 20mm and the gap under a 1m straight-edge placed transversely shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm. The finished surface shall be 5mm above kerbs and pavement edge treatments. All edges shall be chamfered and no sharp edges left exposed. Crack widths shall not exceed 2mm at any point.

7.7 Protection of Pavement

Traffic shall be kept off all footpaths, crossings and cycleways until they have achieved a strength of 20 MPa.

7.8 Repairs

Any defective concrete shall be replaced by removing and reconstructing the section of path between contraction joints.

7.9 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.
7.10 Traffic Signs

All regulatory traffic signs shall be reinstated prior to the removal of the traffic management. All information signs shall be reinstated as soon as practicable. All traffic signs shall be reinstated in terms of clause 24.0 - Traffic Signs.

7.11 Completion

Site shall be clean and tidy on completion of work with all surplus material removed.

7.12 Testing

The Contractor shall supply to the Engineer sufficient information to confirm all other performance criteria have been achieved.

7.13 Measurement of Work and Basis of Payment

7.13.1 Path Construction

Paths shall be paid per m² constructed to the nearest m². The rate shall include sawcutting, excavation and disposal of spoil, formwork, metalcourses, concrete and adjustment of surface boxes not scheduled separately.

7.13.2 Vehicle Crossings

Vehicle crossings shall be paid per m² constructed to the nearest m². The rate shall include for all excavation and disposal of spoil, formwork, metalcourses, concrete and adjustment of surface boxes not scheduled separately.

7.13.3 Unsuitable Foundations

The excavation of unsuitable foundations shall be paid per m³ solid volume of excavation agreed, to the nearest m³, including disposal.

Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

7.13.4 Filling

Filling of the excavated unsuitable foundation shall be paid per m³ solid volume, to the nearest m³, and shall include for the supply, transport, placing, compaction and trimming of the material.

Measurement of fill shall be determined from the volume of unsuitable foundations being filled.

7.13.5 Surface Boxes

The adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing stormwater inspection openings, and traffic signal loop toby boxes shall be
included in the rate for path or cycleway construction or vehicle crossings.

Payment for the adjustment of stormwater and sewerage manhole tops shall allow for all work involved.

7.13.6 Traffic Signs
Payment for the relocation of traffic signs shall be by lump sum or per sign relocated as specified.

8.0 GRITTED FOOTPATHS

8.1 Scope of Work
This specification is for the construction of gravel paths, as detailed on the standard drawings.

Refer to standard details SD 609 or plans for dimensions.

8.2 Excavation and Foundations
Foundations shall be hard, unyielding, free from debris and of uniform bearing. Unsuitable foundation material shall be removed to meet design requirements.

No tolerance on the subgrade level that reduces the depth of construction will be allowed.

The Engineer will require the Contractor to gain confirm that the subgrade achieves the design CBR prior to the placing of the metalcourses.

8.3 Battens
Battens and pegs shall comply with SD 609.

The finished level of the battens shall be within ±10mm of design provided the path crossfall is in the designed direction. The position of the batten shall be within 10mm of design. The peg shall be at least 5mm below the finished batten level.

The line of the batten shall be straight between tangent points with the maximum deviation from a 3m straight-edge laid along the batten face of 5mm with a cumulative total of all visible gaps of not more than 15mm and shall sweep around curves without kinks, flats, or angles in a smooth arc.

8.4 Weed Control
Subgrade and metalcourse shall be treated with a soil sterilant containing dichlobenil, e.g. Prefix-D, to prevent re-growth of weeds for a period of 12 months.
8.5 Metalcourse

*Materials shall comply with CSS: Part 1 - General.*

*At no point on the surface shall the Clegg Impact Value be less than 25.*

Compaction may be measured by Clegg hammer or other approved impact device. These devices shall be calibrated at 12-month intervals.

8.6 Acceptance Criteria

*The finished surface shall be level with kerbs, pavement edge treatments and battens and shall nowhere hold water at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate.*

*The gap under a 3m straight-edge placed longitudinally shall not exceed 5mm with a cumulative total of all visible gaps of not more than 20mm and the gap under a 1m straight-edge placed transversely shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm. Gaps shall apply at Practical Completion only.*

8.7 Surface Boxes

*Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.*

8.8 Completion

*The site shall be clean and tidy on completion of work with all surplus material removed.*

8.9 Measurement of Work and Basis of Payment

8.9.1 Path Construction

Paths shall be paid per m$^2$ constructed to the nearest m$^2$. The rate shall include excavation and disposal of spoil, battens, weed control, metalcourses and adjustment of surface boxes not scheduled separately.

8.9.2 Unsuitable Foundations

The excavation of unsuitable foundations shall be paid per m$^3$ solid volume of excavation agreed, to the nearest m$^3$, including disposal.
Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

**8.9.3 Filling**
Filling of the excavated unsuitable foundation shall be paid per m³ solid volume, to the nearest m³, and shall include for the supply, transport, placing, compaction and trimming of the material.

Measurement of fill shall be determined from the volume of unsuitable foundations being filled.

**8.9.4 Surface Boxes**
The adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing stormwater inspection openings, and traffic signal loop toby boxes shall be included in the rate for path, vehicle crossing or cycleway construction.

Payment for the adjustment of stormwater and sewerage manhole tops shall allow for all work involved.

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**9.0 REPAIRS AND RESURFACING OF FOOTPATHS, VEHICLE CROSSINGS AND CYCLEWAYS**

**9.1 Scope of Work**
This specification is for the repair and resurfacing of asphaltic concrete footpaths, vehicle crossings and cycleways.

**9.2 Cutting Back Berms to Line Out Path**

All existing vegetation (i.e. weeds in cracks and grass overgrowing the path edge) in the path area to be resurfaced shall be sprayed with an approved herbicide at least two weeks prior to the cutting back. All dead vegetation, soil etc shall be removed from the path area and disposed of.

Berms shall be cut back as close as possible behind the batten line to minimise berm restoration.

**9.3 Removal of Lichen**
The Contractor may remove lichen from the surface mechanically or by spraying with a chemical approved by Environment Canterbury for this purpose. Lichen should be removed prior to the application of tack coat and surfacing.

**9.4 Excavation and Backfilling of Failed Areas and Service Strips**

Areas to be treated shall be marked by the Engineer.
Excavation and backfilling shall be carried out in accordance with clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways. Seal at edges of excavation shall be sawcut and protected from damage.

Battens and pegs complying with SD 607 and clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways shall be laid along all edges of the repair where they coincide with the path edge and the path edge is not contained by a concrete kerb or foundation. The batten on the lower edge of the path shall not restrict water runoff.

Metalcourse depths shall be 75mm for footpaths and service strips, 125mm for residential vehicle crossings and 275mm for commercial crossings in accordance with SD 607. The compacted basecourse surface shall be finished not less than 20mm (30mm for commercial crossings) below the top of batten, kerb or the finished level.

The finished surface shall nowhere hold water and the gap under a 1m straight-edge placed in any direction shall not exceed 10mm with a cumulative total of all visible gaps of not more than 25mm.

Compaction shall be measured by Clegg hammer or approved impact device and at no point on the surface shall the Clegg Impact Value be less than 25 for footpaths and residential crossings, and 35 for commercial vehicle crossings.

9.5 Stormwater Repairs

Areas to be treated shall be marked by the Engineer.

Edges shall be cut prior to excavation to prevent damage to the existing seal.

All pipework shall comply with CSS: Part 3 – Utility Drainage and the pipe shall be cleaned out between the boundary and the kerb at the completion of the work.

9.6 Removal of Existing Seal Only

Seal only shall be removed and disposed of. Edges shall be cut prior to removal of seal to prevent damage to the existing seal.

9.7 Installation of New Battens in Existing Berms

Battens shall comply with SD 607 and clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways. The finished level of the battens shall be set to allow the asphaltic concrete surfacing to be laid in accordance with the requirements of clause 9.8 – Asphaltic Concrete.

9.8 Asphaltic Concrete

Asphaltic concrete shall comply with CSS: Part 1 - General. Asphaltic concrete shall be uniform and dense in texture. All asphaltic concrete
shall have air voids not less than 2.5% and not more than 11.0% when laid and compacted.

All tests should achieve these criteria. However, if there are suitable construction records confirmed or audited by the Engineer that prove a better result is not achievable, the work will be accepted as meeting the performance criteria.

9.8.1 **Asphaltic Concrete Patching (levelling course)**
Surface and tack coat shall comply with the requirements of clause 9.8.2 – Asphaltic Concrete Surfacing.

9.8.2 **Asphaltic Concrete Surfacing**
Tack coat shall be applied in accordance with clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways. If specifically required the surface shall be inspected and approved by the Engineer prior to the application of the tack coat.

The nominal compacted depth shall be 15mm with a minimum compacted depth of 10mm over high spots. Over path and residential crossing repair areas the depths shall be 20mm and for commercial crossing areas 30mm. No tolerance that reduces these depths will be accepted.

The finished surface shall nowhere hold water. The gap under a 3m straight-edge placed longitudinally shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm for cycleways and 20mm otherwise and the gap under a 1m straight-edge placed transversely shall not exceed 5mm with a cumulative total of all visible gaps of not more than 7mm for cycleways and 10mm otherwise. For new construction, the finished surface shall be –0mm, +5mm above kerbs, pavement edge treatments and battens.

All construction joints shall be at right angles to the kerb or batten and shall be butt jointed and tack coated.

9.8.3 **Additional resurfacing widths**
Where the full width of the existing footpath (or crossing) is not being reconstructed, additional resurfacing shall be carried out as follows:
- Where the footpath surface is less than 48 months old, the entire footpath width shall be resurfaced.
- Where the reconstructed width of the footpath exceeds 70% of the footpath width, the entire width shall be resurfaced.
- Where the reconstructed area is within 300 mm of the footpath’s support edge or seal joint, this intermediate area shall be included in the resurfacing area.
- Where a trench crosses the footpath from property boundary to kerb in a surface less that 48 months old the resurfaced area shall be a minimum width of 1.0m. In all other cases the
resurfacing shall be reinstated to a minimum width of 300 mm.

9.9 Weed Control

The whole resurfaced footpath area shall not have weed re-growth for a period of 12 months. Only a soil sterilant containing dichlobenil, e.g. Prefix-D, or an herbicide containing glyphosate and metsulfuron, e.g. Roundup, shall be used.

If weed re-growth occurs within the 12-month period the Contractor shall be responsible for removing the weeds and repairing the damage to the asphaltic concrete surfacing. The repairs must comply with this specification in all respects.

9.10 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

9.11 Traffic Signs

All regulatory traffic signs shall be reinstated prior to the removal of the traffic management. All information signs shall be reinstated as soon as practicable. All traffic signs shall be reinstated in terms of clause 24.0 - Traffic Signs.

9.12 Completion

Site shall be left clean and tidy on completion of the resurfacing in each street with all surplus material, especially on berms and garden strips removed from the site.

All soil required for berm works shall be placed within two weeks of completion of the resurfacing in the street.

9.13 Measurement of Work and Basis of Payment

9.13.1 Sawcutting
Sawcutting shall be paid per lineal metre, to the nearest 0.2m.

9.13.2 Reconstruction (Repairs)
Payment shall be made per m², to the nearest m², and shall include removal of seal, excavation and disposal of spoil, battens, backfilling and compaction of metalcourse. This rate includes the extra depths in the asphaltic concrete surfacing in these areas.
As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

9.13.3 Service Strips
Payment shall be per metre (nominally 300mm wide), to the nearest 0.2m and shall include excavation, disposal of soil, backfilling and compaction of metalcourses. This rate shall include the extra depths in the asphaltic concrete surfacing in these areas.

9.13.4 Reshaping Paths Behind Cutdowns
Payment shall be made per m², to the nearest m², and shall include removal of seal, excavation and disposal of spoil, backfilling and compaction of metalcourse. This rate shall include the extra depths in the asphaltic concrete surfacing in these areas.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

9.13.5 Unsuitable Foundations
The excavation of unsuitable foundations shall be paid per m³ solid volume of excavation agreed, to the nearest m³, including disposal. Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

Filling of the excavated unsuitable foundation area shall be paid for per m³ solid measure and shall include the supply, placing and compaction of the material.

9.13.6 Stormwater Repairs
Payment shall be per metre of actual pipe repaired, to the nearest 0.2m and shall include cutting, excavation and disposal of old pipe, supply and installation of new pipe, fittings, backfilling and cleaning of pipe.

9.13.7 Removal of Existing Seal
Payment shall be by m², to the nearest m², and shall include removal of seal and disposal of spoil.

9.13.8 Battens
Payment shall be per metre of battens installed, to the nearest 0.2m, and shall include all work involved.

9.13.9 Asphaltic Concrete Patching (levelling course)
Payment shall be by tonne authorised to be laid and shall include sweeping of the surface, tack coating, and the supply, laying and compaction of the asphaltic concrete.
Where the quantity of levelling required for a street is expected to be less than 4 tonnes the Contractor and the Engineer shall estimate the quantity of patching and that shall be the quantity of patching claimed for that street. If it is expected to be over 4 tonnes, the patching shall be carried out separately and a docket supplied for payment.

9.13.10 Asphalitic Concrete Resurfacing (wearing course)
Payment shall be by m² actually resurfaced, to the nearest m², and shall include cutting back berms, sweeping of the surface, removal of lichen, adjustment of surface boxes not scheduled separately, tack coat, weed control and the supply, laying and compaction of the asphalitic concrete.

9.13.11 Surface Boxes
The adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing stormwater inspection openings and traffic signal loop toby boxes shall be included in the asphalitic concrete surfacing rate.

Payment for the adjustment of stormwater and sewer manhole tops shall allow for all work involved.

9.13.12 Traffic Signs
Payment for the relocation of traffic signs shall be by lump sum or per sign relocated as specified.

10.0 INTERLOCKING CONCRETE BLOCK, COBBLESTONE PAVING AND TACTILE PAVERS

10.1 Scope of Work

This specification is for the supply and laying of Interlocking Concrete Block, Cobblestone and Tactile Paving.

Refer to standard details SD 631-635 or plans for dimensions.

10.2 Materials

Paving shall comply with NZS 3116 “Concrete segmental paving” except where superseded by the following criteria. The colour shall be as specified.

10.2.1 High Pedestrian Areas
Paving shall comply with NZS 3116 “Concrete segmental paving” part 1 and part 2, clause 202(c) and AS/NZS 4455.2 “Masonry units, pavers, flags and segmental retaining wall units – Pavers and flags” section 1, section 2 clauses 2.2, 2.4, 2.5 and appendix A.
Paving shall comply with the specified class as detailed in AS/NZS 4586 and shall have a minimum vehicle skid resistance of 50 tested in accordance with the requirements of TRL Note 27 “Instruction for Using Portable Skid Resistance Tester”.

Paving shall have a minimum modulus of rupture of 6 MPa measured in accordance with AS/NZS 4456.5 “Determining breaking load of segmental paving units” and a maximum abrasion index of 3.5 measured in accordance with AS/NZS 4456.9 “Determining abrasion resistance”.

Material testing shall be carried out in an approved laboratory. Skid resistance testing shall be carried out by an approved laboratory.

10.2.2 Tactile Pavers
Pavers shall comply with AS/NZS 1428.4, clause 2.2.2.

10.3 Excavation and Foundations
Existing surfaces shall be sawcut at the limits of the work.

Ordinary traffic shall not be permitted to traverse the excavated subgrade surface. The Contractor’s operations shall not cause pugging or sponging of the subgrade.

No tolerance on the subgrade level that reduces the depth of construction will be allowed.

10.4 Pavement Edge Treatments
Concrete edge treatments shall have two vertical faces. Cobblestone edge treatments shall be vertical.

The line of the edge treatment shall be straight between tangent points and shall sweep around curves without kinks, flats, or angles in a smooth arc. The maximum deviation from a 3m straight-edge laid along the face of the edge treatment shall be 5mm with a cumulative total of all visible gaps of not more than 10mm.

The position of the edge treatment shall be within 10mm of design. The top surface of a concrete edge treatment within the road shall be between 30mm and 50mm of the finished paver surface. The top surface of all other edge treatments shall be within ±10mm of design.

10.5 Weed Control
Subgrade, metalcourse and bedding sand shall be treated with a soil sterilant containing dichlobenil, e.g. Prefix-D, to prevent re-growth of weeds for a period of 12 months.
10.6 **Metalcourse in Footpath Areas**

*Materials shall comply with CSS: Part 1 - General.*

The surface of the compacted metalcourse shall nowhere hold water, and there shall be no point that will vary more than 8mm under a 3m straight-edge laid in any direction with a cumulative total of all visible gaps of not more than 25mm.

Compaction may be measured by Clegg hammer or other approved impact device. These devices shall be calibrated at 12-month intervals. At no point on the surface shall the Clegg Impact Value be less than 25 for footpaths and residential crossings, and 35 for commercial vehicle crossings.

10.7 **Sub-Base Metalcourse in Carriageway Areas**

*Materials shall comply with CSS: Part 1 - General.*

The sub-base metalcourse surface shall be maintained smooth, compact and true to grade and in such a condition that there is adequate drainage at all times.

The Contractor’s operations shall not cause pugging or sponging of the subgrade.

**CCC pitrun and CCC AP65 shall be compacted to a minimum dry density of 2,150kg/m³. This includes the filling in unsuitable foundation areas.**

The finished compacted surface shall be uniform and dense in texture and shall not have segregated areas. It shall be within the following tolerances of design: -25mm, +5mm.

The finished surface shall nowhere have depressions that hold water and there shall be no point on the surface that will vary more than 25mm either from a 3m straight-edge laid parallel to the centre of the road, or from a camber board placed at right angles to the centreline.

10.8 **Basecourse in Carriageway Areas**

*Materials shall comply with TNZ M/4:AP40.*

The basecourse shall be placed in uniform layers by a suitable method to avoid segregation and shall be compacted to a minimum dry density of 2,150kg/m³.

The finished compacted surface shall be within the following tolerances from design: -5mm, +15mm at any point on the general surface, ±5mm at concrete channel edges and existing levelled edges.

The finished surface shall nowhere have depressions that hold water and there shall be no point on the surface that varies more than 12mm from a
3m straight-edge placed parallel to the centre of the road, or from a camber board placed at right angles to the centreline with a cumulative total of all visible gaps of not more than 25mm.

The basecourse shall be compacted to a uniformly dense, stable condition and shall not wave or creep under rolling. The finished surface just prior to laying bedding sand and paving shall be uniform in texture with no segregated areas.

10.9 Paving

Laying shall comply with NZS 3116 “Concrete segmental paving” and the Cement and Concrete Association of New Zealand’s publications, “IB67 1988 Interlocking Concrete Block Road Pavements” and “IB68 1989 Construction of Concrete Block Paving” except where superseded by this specification. All paving shall have a header strip unless otherwise specified.

Plain pavers shall be cut with a power saw. Rumbled cobblestones may be cut with guillotine cutters. The discharge of water from sawcutting pavers shall comply with CSS: Part 1 - General. Cut pavers shall have edges parallel to the adjacent paver, edge treatment or surface opening.

Joints shall be kept filled with jointing sand during the defects liability period.

10.9.1 Tactile Pavers

The installation of tactile pavers shall be in accordance with RTS 14 or as specified.

10.10 Acceptance Criteria

The finished pavement surface shall be within $\pm 10$mm of the design level except at drainage channels and edge treatments. The pavement surface shall be finished between 2mm and 5mm above the channel or edge treatment at the end of the defects liability period. The difference in level between adjacent blocks shall not exceed 2mm. The joint widths shall be between 2mm and 5mm with an average over the entire pavement of 3mm.

The finished pavement surface shall nowhere have depressions that hold water and there shall be no point on the surface that will vary more than 8mm under a 3m straight-edge laid in any direction with a cumulative total of all visible gaps of not more than 15mm, except where design considerations dictate otherwise.

10.11 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted...
in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

10.12 Traffic Signs

All regulatory traffic signs shall be reinstated prior to the removal of the traffic management. All information signs shall be reinstated as soon as practicable. All traffic signs shall be reinstated in terms of clause 24.0 - Traffic Signs.

10.13 Measurement of Work and Basis of Payment

10.13.1 Excavation
Excavation shall be paid per m² surface area removed, to the nearest m² and the rate shall include disposal.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

10.13.2 Sawcutting, Bituminous Material Removal, Unsuitable Foundations and Filling
Payment for these items will be as detailed in clause 6.0 – Asphaltic Concrete Paths, Vehicle Crossings and Cycleways.

10.13.3 Pavement Edge Treatments
Pavement edge treatments shall be paid per lineal metre to the nearest 0.2m. The rate shall include for all excavation and disposal of spoil, formwork and curing etc.

10.13.4 Metalcourses in Footpath Areas
Metalcourses shall be included in the rate for paving of footpath areas and shall include supply, placing, compaction, trimming and testing.

10.13.5 Metalcourses in Carriageway Areas
Sub-base metalcourse and basecourse shall be paid per m² constructed, to the nearest m². The rate shall include for all work involved including supply, placing, compaction, trimming and testing.

10.13.6 Paving in Footpath Areas
Paving shall be paid per m² constructed, to the nearest m² and the rate shall include metalcourses, sand bedding, weed control, supply and laying of pavers including header strips, cutting, jointing sand including over the Defects Liability Period, compaction and adjustment of surface boxes not scheduled separately. Paving shall also include concrete infill in accordance with Clause 310.2, NZS 3116 “Concrete segmental paving”.

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10.13.7 Paving in Carriageway Areas
Paving shall be paid per m² constructed, to the nearest m² and the rate shall include for all work including sand bedding, weed control, supply and laying of pavers including header strips, cutting, jointing sand including over the Defects Liability Period and compaction and adjustment of surface boxes not scheduled separately. Paving shall also include concrete infill in accordance with Clause 310.2, NZS 3116 “Concrete segmental paving”.

10.13.8 Tactile Pavers
Payment shall be per paver and shall include sawcutting, removal of existing seal and disposal of spoil, sand bedding, weed control, supply and laying of pavers, jointing sand including over the Defects Liability Period, compaction and restoration.

Where tactile pavers are laid in tandem with new footpaths, tactile pavers shall be paid extra over the footpath construction specified in clause 6.11 – Asphalitic Concrete Paths, Vehicle Crossings and Cycleways Measurement of Works and Basis of Payment.

10.13.9 Ramp Construction
Ramp construction shall be paid by metre road width to the specified ramp length. The rate shall include sawcutting, removal of existing seal and metalcourse where necessary, the supply and installation of the asphalitic concrete and the roadmarking of the ramps.

10.13.10 Surface Boxes
The adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing stormwater inspection openings, and traffic signal loop toby boxes shall be included in the rate for interlocking concrete block construction.

Payment for the adjustment of stormwater and sewerage manhole tops shall allow for all work involved.

10.13.11 Traffic Signs
Payment for the relocation of traffic signs shall be by lump sum or per sign relocated as specified.

11.0 CARRIAGEWAY AND SHOULDER CONSTRUCTION AND REPAIRS

11.1 Scope of Work
This specification is for the construction of carriageways and shoulders, and carriageway repairs. This includes excavation, sub-base metalcourse and basecourse.
11.2 Excavation and Foundations

Existing sealed surfaces shall be sawcut at the limits of the work unless otherwise specified.

No tolerance on the subgrade level that reduces the depth of construction will be allowed. Unsuitable foundation soils shall be removed to meet design requirements.

Ordinary traffic shall not be permitted to traverse the excavated subgrade surface. The Contractor’s operations shall not cause pugging or sponging of the subgrade.

11.3 Sub-base Metalcourse

Materials shall comply with CSS: Part 1 - General.

CCC pitrun and CCC AP65 shall be compacted to a minimum dry density of 2,150kg/m$^3$. This includes the filling in unsuitable foundation areas.

The Contractor’s operations shall not cause pugging or sponging of the subgrade. Contractors shall match site conditions with their plant selection and construction techniques e.g. layer depth, to ensure this does not occur.

The sub-base metalcourse surface shall be maintained smooth, compact and true to grade and in such a condition that there is adequate drainage at all times.

The finished compacted surface shall be within the following tolerances of design: -25mm, +5mm. It shall be uniform and dense in texture and shall not have segregated areas.

The finished compacted surface shall nowhere have depressions that hold water and there shall be no point on the surface that will vary more than 25mm either from a 3m straight-edge laid parallel to the centre of the road, or from a camber board placed at right angles to the centreline.

11.4 Basecourse

Materials shall comply with TNZ M/4:AP40 and shall be compacted to a minimum dry density of 2,150kg/m$^3$.

The material shall be placed in uniform layers by a suitable method to avoid segregation. It shall be compacted to a uniformly dense, stable condition in which it does not wave or creep under rolling.

The finished compacted surface shall be within the following tolerances from design. -5mm, +15mm at any point on the general surface, ±5mm of design level at concrete channel edges and existing sealed edges.
The finished surface shall nowhere have depressions that hold water and there shall be no point on the surface that varies more than 12mm from a 3m straight-edge placed parallel to the centre of the road, or from a camber board placed at right angles to the centreline with a cumulative total of all visible gaps of not more than 25mm.

The finished surface just prior to sealing or surfacing shall be uniform in texture, have no segregated areas, excess dust, or excess moisture.

Note that the finished sealed or surfaced basecourse surface shall have average NAASRA roughness counts as specified.

11.5 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

11.6 Acceptance Criteria

Acceptance will be measured by one of the three methods outlined below. The method applicable and values to be obtained will be specified.

11.6.1 By Clegg Hammer

11.6.2 By Nuclear Densometer

Individual readings with the nuclear densometer in the backscatter mode shall be at completely random locations and at not greater than 10m longitudinal intervals.

No readings shall be lower than the specified minimum.

11.6.3 By Benkelman Beam

Benkelman Beam testing is specified in the TNZ T/1 document, which sets out equipment and test method requirements.

Beam testing shall commence with a test 5m beyond the extent of work, then at 15m intervals for projects greater than 100m in length, or 10m intervals for projects less than 100m. In each case the final reading shall also be beyond the end of the work. The readings beyond the work should not form part of the calculation, as they are required for asset research purposes only.

The true statistical 95%ile or D95 calculation is not considered valid for the relatively low numbers of readings taken for sections of carriageway prepared for chipsealing or asphaltig.
When 20 or more readings are taken, one reading higher than the specified 95%ile limit is permissible. For less than 20 readings, all shall comply. (Obviously for 40 readings, two readings higher than the specified limits are permissible, and so on). No readings shall exceed the specified maximums.

11.6.4 Requirements and Notes Relating to these Criteria

The Engineer will carry out the pavement design using the Guide to Pavement Technology - Part 2: Pavement Structural Design as modified by the New Zealand supplement and the Circly Pavement design software as the basis for the design, unless otherwise specified.

The Engineer will provide the Contractor with the assumed design information prior to work commencing. This will include:

- Assumed Subgrade Type.
- Assumed CBR.
- EDA’s.
- Borehole Information (when taken and available).

The Contractor shall be responsible for checking the actual subgrade to ensure it complies with the design assumptions. If it is different from that assumed, or subgrade conditions change during excavation, the Contractor and the Engineer shall discuss this and agree on a new pavement depth to meet the above deflection requirements.

To convert penetrometer readings to CBR values, when confirming pavement designs, use Figure 5.2 “Correlation of Dynamic Cone Penetration and CBR” from Guide to Pavement Technology - Part 2: Pavement Structural Design.

For irregular unsuitable foundation areas up to 50m² the Contractor shall remove the unsuitable material to meet the design requirements. The Contractor shall advise the Engineer as soon as practicable and shall provide the Engineer with the following information: area and depth excavated and marked on the plan; CBR and description of the unsuitable material; CBR and description of material at base of unsuitable material excavation. This information may not be required if the Engineer is present on the site.

For chipseal pavements the Engineer may approve sealing before the deflection criteria are met providing the Contractor obtains complying tests prior to the end of the defects liability period and the Contractor has carried out sufficient tests during construction to show there has been adequate compaction of each layer.

11.7 Testing
11.7.1 **Compaction**
Nuclear density testing shall be carried out by an operator holding Unit Standard 25832 “Use a nuclear density meter to measure compaction of soils, sands, or gravels”. All compaction testing appliances shall have current calibration certificates.

11.7.2 **NAASRA**
The Contractor shall undertake NAASRA testing on the carriageway where specified. The average and maximum readings shall exclude values affected by intersecting streets, platforms and road humps. The Defects Liability Certificate will not be issued until a complying NAASRA test is received.

All NAASRA results shall be based on a minimum of three runs. Test results shall be reported at 20m intervals. The Contractor shall supply with any test results a calibration test result taken within the week immediately prior to this test. Calibration sites can be obtained from Council.

Christchurch City Council will have the NAASRA testing machine in Christchurch at some period during March/April and November/December of each year. The Contractor may arrange to carry out their testing in this period also or may arrange a separate visit.

Contractors should also be aware that, as well as the ARRB Road Info Ltd vehicle-based Laser Profiler, and other High Speed profilers, a NAASRA Walking profiler is available for hire from ARRB Road Info Ltd (Ph. (06) 759-4960) for NAASRA counts.

The Contractor shall supply to the Engineer sufficient information to confirm all performance criteria have been achieved.

11.8 **Measurement of Work and Basis of Payment**

11.8.1 **Sawcutting**
Sawcutting shall be per metre, to the nearest 0.2m. Rates are provided for depths in increments of 50mm.

11.8.2 **Excavation for Carriageway Construction**
Excavation shall be by m³ solid volume, to the nearest m³, as measured on the longitudinal section and cross sections and shall include all work including disposal. Excavation shall cover the full area of the sub-base metalcourse, as defined in clause 11.8.7 – Sub-base Metalcourse and shall include disposal.

Because existing and proposed ground levels are regular, a relatively accurate assessment of the proposed excavation quantities was possible. The Contractor should satisfy themselves that the quantities proposed are correct prior to
formal contract agreement, as modification of quantities will only be accepted on the order of the Engineer.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

11.8.3 Excavation for Shoulder Construction and Repairs
Excavation is paid by m², to the nearest m², excavated to the specified depth and shall include all work including disposal. Excavation shall cover the full area of the sub-base metallocourse as defined in clause 11.8.7 – Sub-base Metallocourse.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

11.8.4 Bituminous Material Removal
The scarification and removal of bituminous material shall be paid per m³, to the nearest m³, and shall include removal of seal and disposal of spoil.

11.8.5 Cut to Fill
Cut to fill shall be by m³ solid volume, to the nearest m³, and shall include all work involved in reclaiming approved material from the excavation and placing and compacting in the fill area, whether direct or via a stockpile.

Because existing and proposed ground levels are regular, a relatively accurate assessment of the proposed excavation quantities was possible. The Contractor should satisfy themselves that the quantities proposed are correct prior to formal contract agreement, as modification of quantities will only be accepted on the order of the Engineer.

11.8.6 Unsuitable Foundations
The excavation of unsuitable foundations shall be paid per m³ solid volume of excavation agreed, to the nearest m³, including disposal. In carriageway construction this rate shall apply to irregular areas and depths up to 50m². Areas larger than 50m² shall be paid at the rate for general excavation. Measurement of excavation for unsuitable foundations shall be by using the agreed dimensions.

Filling of the excavated unsuitable foundation area shall be paid per m³ solid measure, to the nearest m³, and include the supply, placing and compaction of the material.

In carriageway construction, the filling of unsuitable foundation areas larger than 50m² shall be paid by adjusting the rate of the sub-base metallocourse in proportion to the extra depth.
11.8.7 **Sub-base Metalcourse**
Sub-base metalcourse layers shall be paid by m², to the nearest m², to the specified compacted depth. The rate shall include supply, placing, compaction and trimming.

Where the shoulder abuts a new kerb and channel, the sub-base metalcourse area shall be measured to the fender of the new kerb and channel. Metalcourse placed under the new kerb and channel, to the limits as shown on SD 625, shall be included in the scheduled item for kerb and channel.

11.8.8 **Basecourse**
Basecourse layers shall be paid by m², to the nearest m², to the specified compacted depth. The rate shall include supply, placing, compaction and trimming.

11.8.9 **Surface Boxes**
Payment for the alteration of surface boxes shall be by lump sum or per box or manhole adjusted as specified and shall include for all work and materials involved, including repainting.

11.8.10 **Testing**
NAASRA testing shall be a lump sum and payment shall be for complying tests only.

The cost of all other construction testing up to the point of showing the pavement meets the specified criteria shall be included in the rates for excavation and metalcourse. This includes testing during the defects liability period if compliance was not achieved prior to sealing. Any additional tests ordered by the Engineer will be paid as a variation if they show compliance with the specification.

### 12.0 CARRIAGeway MAINTEnANCE

#### 12.1 Scope of Work

This specification is for carriageway maintenance work

The work required will be either defined in the specification or marked on site by the Engineer.

#### 12.2 Materials

*All materials shall comply with CSS: Part 1 - General.*

*All asphaltic concrete used in this specification shall comply with requirements of clause 17.0 - Laying of Asphaltic Concrete on Carriageways.*
12.3 Texturising and Repairs using Bitumen and Chip

Binder shall comply with TNZ M/1. Chip shall comply with TNZ M/6.

The surface shall be clean, free from dust, sand, grit or any other material that could impair the adhesion of the bitumen.

All surplus chip shall be removed within 48 hours.

The surface texture, as measured by sand circle, shall be within the following limits: Grade 5 chip < 170 mm; Grade 6 chip < 185 mm. The surface shall not bleed or flush bitumen.

12.4 Potholes and Edgebreak

Potholes and edgebreak shall be trimmed vertical, cleaned, tack coated and filled with asphaltic concrete.

The finished surface profile shall match the general profile of the adjacent surface. The finished surface shall nowhere hold water and the gap under a 3m straight-edge placed in any direction shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm.

12.5 Failed Areas

Where defined, failed areas shall be excavated and backfilled as specified. All work shall comply with clause 11.0 – Carriageway and Shoulder Construction and Repairs.

The finished surface profile shall match the general profile of the adjacent surface. The finished surface shall nowhere hold water and the gap under a 3m straight-edge placed in any direction shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm.

12.6 Shape Correction

Depressions, trenches and around service boxes, shall be shape corrected with AC 10.

The finished surface profile shall match the general profile of the adjacent surface. The finished surface shall nowhere hold water and the gap under a 3m straight-edge placed in any direction shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm.

12.7 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted...
in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

12.8 Removal of Excess Seal of Manholes

Excess seal shall be removed so the finished level of the surface surrounding the manhole is flush with the manhole top and road surface.

The finished surface shall be either a milled surface in sound seal or a new asphaltic concrete surface. Where the metalcourses are exposed, the surface shall be treated as a pothole.

12.9 Measurement of Work and Basis of Payment

12.9.1 Texturising and Repairs using Bitumen and Chip
Payment shall be per m², to the nearest m², for the area treated and the rate shall include surface preparation, supply and laying of bitumen and chip, removal of surplus chip and maintenance.

12.9.2 Potholes and Edgebreak
Payment shall be per tonne of asphaltic concrete laid or per pothole repaired and shall include surface preparation including trimming and cleaning, tack coat, supply and lay asphaltic concrete and maintenance.

12.9.3 Failed Areas
Payment for failed areas shall be per m², to the nearest m², and shall include excavation, disposal of surplus material, supply and place metalcourses and surfacing.

As bituminous materials may require disposal separately from other hardfill, the excavation and disposal of this material is scheduled separately.

12.9.4 Shape Correction
Payment for shape correction using asphaltic concrete shall be per tonne laid and shall include surface preparation, tack coat, supply, lay and compact asphaltic concrete.

12.9.5 Surfaces Boxes
Payment for the alteration of surface boxes shall be by lump sum or per box or manhole adjusted as specified and shall include repainting.

12.9.6 Removal of Excess Seal at Manholes
Payment shall be per manhole treated and include excavation, disposal of surplus material, supply and placing of surfacing, if required, and milling etc.
13.0 LAYING OF GEOTEXTILES AND GEOGRIDS

13.1 Scope of Work

This specification is for the laying of geotextiles and geogrids in conjunction with metalcourse construction.

13.2 Materials

Materials shall be as specified and shall comply with all clauses of TNZ F/7 except that test results shall be available on request.

13.3 Installation

The geotextile or geogrid shall be laid to TNZ F/7 at the depth specified.

13.4 Measurement of Work and Basis of Payment

The geotextile or geogrid shall be paid per m² of plan area covered, to the nearest m². No extra payment will be made for laps or returns. The rate shall include all testing.

14.0 CARRIAGEWAY CHIPSEALING

14.1 Scope of Work

This specification is for the chipsealing of carriageways using cutback, straight run or emulsified binders, and includes first coat, second coat and resealing work.

Limits of work shall be marked or defined by the Engineer.

14.2 Materials

14.2.1 Binders

All binders and fluxes shall comply with TNZ M/1 and TNZ P/17.

Adhesion agents shall meet TNZ M/13.

14.2.2 Sealing Chip

All sealing chip shall meet TNZ M/6. Chip grades shall be as specified.
14.3 Application

All work shall be carried out in accordance with the relevant parts of TNZ P/17 except where superseded by this specification. Provide documentation through the Contract Quality Plan.

The Contractor shall design binder application rates from the binder type, chip grade and estimated traffic volumes supplied and rates shall be provided to the Engineer prior to starting work. The binder application rate worksheet shall be provided to the Engineer prior to all first coat seals.

All sprayers shall meet the requirements of BCA E/2 and have a current E/2 certificate.

Sealing records for first coat seals shall be supplied to the Engineer within five working days of spraying and shall include but not be limited to the date sprayed, type and penetration grade binder, type and quantity of all additives, spray temperature, air temperature, area sprayed and actual hot and residual application rates for each spray run.

14.4 Acceptance Criteria

The finished carriageway shape shall be consistently convex across the constructed width, unless otherwise specified. All mate-ins to existing carriageways or concrete kerbs shall be flush.

14.4.1 First Coat Seal

The finished surface shall be of uniform texture and appearance and shall meet the sand circle test limits specified below at the end of the defects liability period.

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<tr>
<th>Surface Type (chip grade)</th>
<th>Sand Circle Diameter</th>
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</tr>
<tr>
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</tr>
<tr>
<td>5</td>
<td>&lt;170</td>
</tr>
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<td>6</td>
<td>&lt;185</td>
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<td>&lt;165</td>
</tr>
<tr>
<td>3/5</td>
<td>&lt;165</td>
</tr>
</tbody>
</table>

14.4.2 Reseals

The finished surface shall comply with the requirements of clause 9 of TNZ P/17.

For assessment of single coat seals, multi-layer seals, texturising seals and void fills, the pavement will be divided into lots between centres of intersection streets or 200m whichever is the lesser length.
14.5 Trees

The Contractor shall ensure that all trees in the street remain undamaged during sealing and no binder shall be applied within 600mm of the trunk of any tree within the area to be used. All work in the vicinity of trees shall be carried out in accordance with CSS: Part 1 - General.

14.6 Removal of Surplus Chip and Waste Materials

All surplus chip in stockpiles on the road reserve shall be removed immediately following the completion of each day’s work, unless otherwise approved.

All areas with essential road markings shall be swept sufficiently to allow reinstatement of markings within 24 hours.

After the speed restriction signs are removed and prior to the issue of the Defects Liability Certificate, the surface shall be regularly maintained to the standards defined in clause 7.3 of TNZ P/17. Any loose chip within this limit that is causing a safety hazard or a nuisance to the public shall be removed. Loose chip at intersections is deemed to be a safety hazard. Nuisance to the public is when a reasonable complaint is made and this could include loose chip on berms, footpaths and driveways.

14.7 Reinstatement of Pavement Markings

Intersection ‘Stop’ and ‘Give Way’ marking and fire hydrants shall be reinstated within 24 hours of sealing. All other roadmarking shall be remarked within 24 hours of initial carriageway sweeping. All roadmarking shall be carried out in terms of clause 25.0 - Roadmarking, Raised Pavement Markers, Kerb Markers and Edge Markers.

14.8 Maintenance

The Contractor shall maintain the seal in accordance with TNZ P/17 except where superseded by this specification. For seals using chip sizes Grade 5 or 6, the repair must be performed with the same grade as the original chip. The chip used for repairs shall also be from the same source as the original construction.

All defect repairs carried out require a Letter of Guarantee covering those repairs for a period of twelve months following the issue of the Defects Liability Certificate. All repairs must meet all of the contract acceptance criteria during the period of guarantee.

If at any time during the Period of Defects Liability the area of chip loss in any lot exceeds 10% of the total area sealed in that lot the whole carriageway in that lot shall be resealed, unless there is sufficient evidence to support patching only.

The Contractor shall ensure that all reseal repairs are carried out to a standard that will not contribute to flushing in the new seal. Any area of
flushing caused by the resealing operation shall have all excess bitumen REMOVED so that all acceptance criteria are achieved. Any adjacent carriageways affected shall also be repaired.

14.9 Measurement of Work and Basis of Payment

14.9.1 Chipsealing
Chipsealing shall be paid per m², to the nearest m², for areas that meet the acceptance criteria. This shall include preparation of the surface including sweeping, removal of raised pavement markers, protection of street furniture, traffic and parking control, supply, spraying and spreading of binder and sealing chip and sweeping, removal and disposal of surplus chip. The provision of sealing design and RAMM top surface records shall be included in this rate.

The sealed area does not include any overlaps onto kerbs or adjacent sealed areas. These areas shall be included within the sealing rate.

14.9.2 Texturising
Texturising shall be paid per m² texturised, to the nearest m², and shall include sweeping and removal of surplus chip if required.

14.9.3 Service Boxes
Painting of valves and hydrants shall be paid for each box painted. The rate for fire hydrants shall include the marker, triangle and circle if required.

14.9.4 Road Markings
Reinstatement of existing road markings shall be paid as a lump sum.

15.0 SLURRY SEALING

15.1 Scope of Work

This specification is for the supply and laying of slurry seal.

Limits of the work shall be as marked on site by the Engineer.

15.2 Materials

All materials shall comply with the relevant parts of Roading NZ 9806.

15.3 Surface Preparation

All work shall be carried out in accordance with the relevant parts of Roading NZ 9806 except where superseded by this specification.
Stormwater contamination shall be prevented and all discharges shall be controlled in accordance with CSS: Part 1 - General. All sumps, manhole covers, toby boxes or any other carriageway fittings shall be properly protected from laying operations.

15.4 Acceptance Criteria

All work shall be carried out in accordance with the relevant parts of Roading NZ 9806.

15.5 Trees

All work in the vicinity of trees shall be carried out in accordance with CSS: Part 1 - General. The Contractor shall ensure that all trees in the street remain undamaged during sealing and no slurry shall be applied within 600mm of the trunk of any tree.

15.6 Removal of Surplus and Waste Material

All sumps, manhole covers, toby boxes or any other carriageway fittings shall be promptly cleaned and freed after the work. Paper or fabric placed across the pavement for slurry runs, and binder twine or cord lines used to define the edges of the sealing shall be uplifted immediately after the slurry is spread. These items and all other material shall be stored neatly and removed from the site at the end of the working day. Unless otherwise approved by the Engineer, the Contractor shall remove all surplus chip in stockpiles on the road reserve immediately following completion of each days work.

15.7 Reinstatement of Pavement Markings

All roadmarking shall be carried out in terms of clause 25.0 - Roadmarking, Raised Pavement Markers and Edge Markers. Intersection ‘Stop’ and ‘Give Way’ marking and fire hydrants shall be reinstated within 24 hours of sealing. All other roadmarking shall be remarked within 48 hours of sealing.

15.8 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

15.9 Testing

Testing shall be carried out in accordance with the relevant parts of Roading NZ 9806.
15.9.1 Trial Application
Prior to commencing the contract works, a test section at least 20m long and 2m wide shall be placed at the Contractor’s cost away from the contract site and using the proposed materials.

The slurry seal shall be placed and rolled in accordance with this specification and shall be checked for laid depth, consistency and break time. An approved laboratory shall carry out tests to determine the asphalt content and aggregate gradation. If the observations and tests indicate that the slurry seal test section does not conform to the specification, the necessary adjustments shall be made and additional test sections shall be constructed for conformance to the specification.

15.9.2 Materials
The Contractor shall supply recently achieved wet track abrasion, wet stripping and wet cohesion tests for the proposed slurry mixes at least one week prior to commencing the contract works.

15.10 Measurement of Work and Basis of Payment

15.10.1 Surface Preparation
Payment for the preparation of the surface shall be per m², to the nearest m² and shall include sweeping, cleaning or removal of detritus and deleterious materials and covering service covers.

15.10.2 Slurry Sealing
Payment for slurry seal shall be per m², to the nearest m².

15.10.3 Service Boxes
Painting of valves and hydrants shall be paid for each box painted. The rate for fire hydrants shall include the marker, triangle and circle if required.

15.10.4 Road Markings
Reinstatement of existing road markings shall be paid as a lump sum.

15.10.5 Testing
The cost of laying test sections and testing samples shall be included in the slurry sealing rate.

16.0 LAYING OF PAVING FABRIC

16.1 Scope of Work

This specification is for the laying of paving fabrics beneath chipseal and asphaltic concrete.
16.2 Materials

The paving fabric shall consist of a non-woven needle punched polyester paving fabric manufactured specifically for this purpose and with the specified properties.

16.3 Preparation of the Surface

The surface prior to tack coating shall be clean and free from surface water, dust, sand, grit or any other material that could impair the adhesion of the fabric.

16.4 Tack coat

The tack coat shall meet the requirements of the paving fabric manufacturer as to type of tack coat and application rate. The Contractor shall provide the Engineer with all details of the tack coat used, spraying temperature, air temperature, area sprayed and the actual application rate for each sprayed run, immediately following the spraying operation.

16.5 Installation

The paving fabric shall be laid immediately after the tack coat is applied. The laid fabric shall not contain wrinkles. Wrinkles shall be removed by cutting the fabric. The Contractor shall follow the manufacturer’s specifications completely.

16.6 Measurement of Work and Basis of Payment

Paving fabric shall be paid per m², to the nearest m², and shall include preparation, tack coat, supply and installation.

17.0 LAYING OF ASPHALTIC CONCRETE ON CARRIAGEWAYS

17.1 Scope of Work

This specification is for the laying of asphaltic concrete on carriageways and includes asphaltic concrete laid in patches and shoulders and as sheeting and overlays.

The limits of work shall be marked or defined by the Engineer.

Current NAASRA counts are available from the Engineer on request.

17.2 Tack coat

The base and edges of all areas to be covered by the asphaltic concrete, except prime coats, shall be tack coated with a bitumen emulsion complying with TNZ M/1 and uniformly applied at a residual application rate of 0.15 l/ m².
The surface prior to tack coating shall be clean and free of surface water, dust, sand, grit or any other material that could impair the adhesion of the tack coat. The application of the tack coat shall consider truck access to the paver and possible tracking by truck wheels.

17.3 Asphalstic Concrete

All asphaltic concrete shall comply with CSS: Part 1 - General and TNZ M/10 and be supplied by an asphalt plant certified to AS/NZS ISO 9001 “Quality management systems – Requirements”. All asphaltic concrete shall be uniform in density and texture and all asphaltic concrete except thin sheeting works shall have air voids not less than 2.5% and not more than 8.0% on joins or 6.0% in any mat.

Asphaltic concrete shall be laid in maximum compacted layer thicknesses as follows: 60mm for AC20, 50mm for CCC AC16 and 30mm for AC10.

The Contractor shall supply all weighbridge dockets, or a verifiable summary, which shall show the date and time loaded, contract number, mix type and temperature and net weight.

17.4 Joints

No uncompleted longitudinal or transverse joins shall be left unprotected and exposed to traffic over night. All joints against existing asphaltic concrete shall be bandaged on the completion of the work.

17.5 Acceptance Criteria

The finished surface shall give a smooth ride with an average NAASRA roughness count of not more than 55mm/km and a maximum count of not more than 75mm/km for new work, and an average count of not more than 65mm/km and a maximum of not more than 90mm/km for shape corrections or overlays of existing pavements.

The finished surface shall be 5mm above channel fenders or concrete kerbs and shall not hold water and there shall be no point where the general surface varies more than 5mm from a 3m straight-edge laid longitudinally, with a cumulative total of all visible gaps of not more than 10mm, or more than 5mm from a 1m straight-edge laid transversely, including across service boxes and joins.

17.6 Reinstatement of Pavement Markings

All roadmarking shall be carried out in terms of clause 25.0 - Roadmarking, Raised Pavement Markers, Kerb Markers and Edge Markers. Intersection ‘Stop’ and ‘Give Way’ marking and fire hydrants shall be reinstated within 24 hours of sealing. All other roadmarking shall be remarked within 24 hours of initial carriageway sweeping.

17.7 Surface Boxes
Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

All surface boxes shall be raised within 72 hours. Surface boxes except fire hydrants may be temporarily covered to remove a traffic hazard except that an indication of their location should be present at all times. Fire hydrants shall be raised immediately if they present a traffic hazard when uncovered.

17.8 Testing

17.8.1 Asphaltic concrete cores
Asphaltic concrete core samples shall be a fair representation of the paved area. All core results shall be returned to the Engineer. Core samples shall be 100mm in diameter. Testing shall be carried out in an approved laboratory.

17.8.2 NAASRA
Refer to clause 11.7.2 – NAASRA for testing requirements and NAASRA testing machine availability.

17.9 Measurement of Work and Basis of Payment

17.9.1 Asphaltic Concrete
Payment for the asphaltic concrete shall be either per m², to the nearest m², or per tonne of asphaltic concrete laid as specified and shall include preparation of the surface, supply and application of tack coat, supply and laying of the asphaltic concrete, bandaging and asphaltic concrete cores.

17.9.2 Road Markings
Reinstatement of existing road markings shall be paid as a lump sum.

17.9.3 Surface Boxes
Payment for the alteration of surface boxes shall be by lump sum or per box or manhole adjusted as specified and shall include for all work and materials involved, including repainting.

17.9.4 Testing
NAASRA testing shall be a lump sum and payment shall be for complying tests only.

Testing of asphaltic concrete cores shall be included in the rate for asphaltic concrete.
18.0 CARRIAGEWAY SHAPE CORRECTION WITH EMULSION MIXES

18.1 Scope of Work

This specification is for the shape correction of carriageways with emulsion mix.

Limits of work shall be marked or defined by the Engineer prior to tendering.

Current NAASRA counts are available from the Engineer on request.

18.2 Emulsion Mix

*The Contractor shall supply to the Engineer details of aggregate gradings, residual binder content and other relevant information for the material to be used seven days prior to the commencement of work.*

18.3 Tack coat

*The surface prior to tack coating shall be clean, free from surface water, dust, sand, grit or any other material that could impair the adhesion of the tack coat.*

*The base of all areas to be covered by the emulsion mix shall be tack coated with a bitumen emulsion complying with TNZ M/1 and uniformly applied at a residual application rate of 0.15 l/m².*

18.4 Joints

*No uncompleted longitudinal or transverse joins shall be left unprotected and exposed to traffic over night. No joins shall be left exposed to traffic over night. Exposed joins shall be made safe with the construction of a temporary ramp that shall be removed prior to the continuation of the work.*

18.5 Acceptance Criteria

*The finished surface shall give a smooth ride with the following average NAASRA roughness counts: streets with an average daily traffic (ADT) of more than 1200 shall have an average NAASRA roughness count of not more than 70mm/km and a maximum count of not more than 90mm/km, streets with an average daily traffic (ADT) of less than 1200 shall have an average NAASRA roughness count of not more than 75mm/km and a maximum count of not more than 100mm/km.*

*The finished surface shall be between –0mm and +5mm above channel fenders or concrete kerbs. It shall have no point where the general surface varies more than 5mm from a 3m straight-edge laid longitudinally, with a cumulative total of all visible gaps of not more than 10mm, or more than 5mm from a 1m straight-edge laid transversely, including across service boxes and joins.*
18.6 **Removal of Surplus Chip and Waste Material**

Any running course shall be removed from sealed carriageways and adjacent effected areas prior to the removal of the temporary speed restriction signs.

18.7 **Reinstatement of Pavement Markings**

All roadmarking shall be carried out in terms of clause 25.0 - Roadmarking, Raised Pavement Markers, Kerb Markers and Edge Markers. Intersection ‘Stop’ and ‘Give Way’ marking and fire hydrants shall be reinstated within 24 hours of sealing. All other roadmarking shall be remarked within 24 hours of initial carriageway sweeping.

18.8 **Surface Boxes**

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

All surface boxes shall be raised within 72 hours. Surface boxes except fire hydrants may be temporarily covered to remove a traffic hazard except that an indication of their location should be present at all times. Fire hydrants shall be raised immediately if they present a traffic hazard when uncovered.

18.9 **Testing**

Refer to clause 11.7.2 – NAASRA for testing requirements and NAASRA testing machine availability.

18.10 **Measurement of Work and Basis of Payment**

18.10.1 **Emulsion Mix**

Payment for emulsion mix shall be per m², to the nearest m², and the rate shall include preparation of surface, supply and application of tack coat, supply and laying of the emulsion mix and removal and disposal of any running course.

18.10.2 **Pre-levelling with Asphaltic Concrete**

Payment for pre-levelling shall be per tonne authorised by the Engineer.

18.10.3 **Road Markings**

Reinstatement of existing road markings shall be paid as a lump sum.
18.10.4 Surface Boxes
Payment for the alteration of surface boxes shall be by lump sum or per box or manhole adjusted as specified and shall include for all work and materials involved, including repainting.

18.10.5 Testing
NAASRA testing shall be a lump sum and payment shall be for complying tests only.

19.0 CARRIAGEWAY SMOOTHING WITH OPEN GRADED POROUS ASPHALT

19.1 Scope of Work
This specification is for the laying of open graded porous asphaltic concrete on carriageways.

Limits of work shall be marked or defined by the Engineer.

Current NAASRA counts are available from the Engineer on request.

19.2 Porous Asphalt
All porous asphalt shall comply with TNZ P/11 and be supplied by an asphalt plant certified to AS/NZS ISO 9001 “Quality management systems – Requirements”. No porous asphalt shall be laid where the pavement surface temperature is less than 10°C.

The Contractor shall supply all weighbridge dockets, or verifiable summary, which shall show the date and time loaded, contract number, mix type and temperature and net weight.

19.3 Tack coat
The surface prior to tack coating shall be clean, free from surface water, dust, sand, grit or any other material that could impair the adhesion of the tack coat.

The base of all areas to be covered by the emulsion mix shall be tack coated with a bitumen emulsion complying with TNZ M/1 and uniformly applied at a residual application rate of 0.15 l/m².

19.4 Joints
No uncompleted longitudinal or transverse joins shall be left unprotected and exposed to traffic over night. No joins shall be left exposed to traffic over night. Exposed joins shall be made safe with the construction of a temporary ramp that shall be removed prior to the continuation of the work.
19.5 Edge Treatment

Where porous asphalt is laid adjacent to the fender, the constructed edge shall be treated in accordance with SD 617.

19.6 Permanent Ramps

All asphaltic concrete shall comply with CSS: Part 1 - General. All ramps shall comply with the requirements of clause 17.0 – Laying of Asphaltic Concrete on Carriageways.

Prior to construction of any ramp the adjacent edge of the friction course shall be trimmed straight and vertical. Ramps shall be keyed into the existing carriageway surface.

The finished ends of the ramps shall be flush with, and shall provide a smooth transition between the new and existing surfaces with a NAASRA roughness no greater than that of the existing surface.

19.7 Acceptance Criteria

The finished surface shall give a smooth ride with an average NAASRA roughness count of not more than 55mm/km and a maximum count of not more than 75mm/km for overlaying new construction work, and an average count of not more than 65mm/km and a maximum of not more than 90mm/km for shape corrections or overlays of existing pavements.

The finished surface shall be between –0mm, +5mm at channel fenders or concrete kerbs. It shall have no point where the general surface varies more than 5mm from a 3m straight-edge laid longitudinally, with a cumulative total of all visible gaps of not more than 10mm, or more than 5mm from a 1m straight-edge laid transversely, including across service boxes and joins.

19.8 Reinstatement of Pavement Markings

All roadmarking shall be carried out in terms of clause 25.0 - Roadmarking, Raised Pavement Markers, Kerb Markers and Edge Markers.

19.9 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.

All surface boxes shall be raised within 72 hours. Surface boxes except fire hydrants may be temporarily covered to remove a traffic hazard.
except that an indication of their location should be present at all times. Fire hydrants shall be raised immediately if they present a traffic hazard when uncovered.

19.10 Testing

Refer to clause 11.7.2 – NAASRA for testing requirements and NAASRA testing machine availability.

19.11 Measurement of Work and Basis of Payment

19.11.1 Porous Asphalt
Payment for porous asphalt shall be either per m², to the nearest m², or per tonne as specified and the rate shall include preparation of surface, supply and application of tack coat and supply and laying of the porous asphalt.

19.11.2 Pre-levelling
Payment for pre-levelling shall be per tonne authorised and the rate shall include preparation of surface, supply and application of tack coat and supply and laying of the asphalitic concrete.

19.11.3 Permanent Ramps
Payment for permanent ramps shall be per tonne and the rate shall include trimming of new friction course, preparation of surface, key-in, supply and application of tack coat and supply and laying of the asphalitic concrete.

19.11.4 Milling
Payment for milling to achieve a flush join with the existing pavement shall be per m², to the nearest m² and shall include disposal of surplus material.

19.11.5 Road Markings
Reinstatement of existing road markings shall be paid as a lump sum.

19.11.6 Surface Boxes
Payment for the alteration of surface boxes shall be by lump sum or per box or manhole adjusted as specified and shall include for all work and materials involved, including repainting.

19.11.7 Testing
NAASRA testing shall be a lump sum and payment shall be for complying tests only.
20.0 PAVEMENT CRACKFILLING

20.1 Scope of Work

This specification is for the crackfilling of cracked carriageway pavements.

20.2 Materials

The crack sealant shall have a minimum softening point of 70°C. The needle penetration at 25°C shall be less than 150mm, the torsional recovery at thirty minutes shall be a minimum of 85% and the ball resilience shall be greater than 50%.

20.3 Preparation of Surface

The cracks shall be pressure cleaned and dried and any loose material removed. An approved crack primer shall be applied if required.

20.4 Application of Crack Sealant

The edges of all patches and cracks less than 5mm wide shall be treated as follows. The Engineer shall be notified of cracks over 5mm.

The crack sealant shall be applied hot and inserted directly into the crack with the surplus screeded off to give a minimum ‘bandage’ width of 50mm, a minimum thickness of 2mm followed by surfacing with coarse sand.

Bandages over 75mm shall be treated to ensure they achieve an equivalent skid resistance to the adjacent pavement.

20.5 Maintenance

The Contractor shall remove excess sand the day following the application of the crack sealant.

Any crack sealant not adhering to the existing surface shall be replaced during the defects liability period.

20.6 Testing

The Contractor shall supply recently achieved softening point, needle penetration, torsional recovery and ball resistance test results. All tests shall be carried out by an approved laboratory and shall be furnished at least one week prior to commencing the crackfilling work.

One 2-litre sample of crack sealant shall be taken for testing by the Contractor twice during the contract to ensure that the sealant conforms to this specification.
Laboratory results shall be forwarded to the Engineer as soon as they become available.

20.7 Measurement of Works and Basis of Payments

Crackfilling shall be paid per metre, to the nearest 0.2m, and shall include all work involved. The cost of all testing shall be included in these rates.

21.0 COLD MILLING OF CARRIAGEWAYS

21.1 Scope of Work

This specification is for the cold milling of carriageways. Limits of work shall be marked or defined by the Engineer.

21.2 Milling

Where the milled area is to be backfilled, all edges shall be finished vertical. No longitudinal or transverse vertical edges shall be left unprotected and exposed to traffic overnight.

All milling machines with a drum width of more that 750mm shall be equipped with a self loading conveyor.

All contaminants shall be intercepted and disposed of in accordance with the requirements of CSS: Part 1 - General.

All stormwater outlets, sumps, service boxes and manholes shall be protected against damage. All spoil shall be removed from the site.

21.3 Finished Surface

The depth milled, after removal of all loose material, shall be −0mm, +5mm of the specified depth. The finished surface shall vary no more than 5mm from a 3m straight-edge laid longitudinally or a 1m straight-edge laid transversely, including between adjacent runs.

21.4 Measurement of Work and Basis of Payment

Payment shall be per m² of milled carriageway, to the nearest 0.1m², and shall include protection of all sumps, stormwater outlets and service boxes from damage and contamination with the milled material and removal of all material resulting from the milling.
22.0 GROOVING OF ASPHALTIC CONCRETE ON CARRIAGeways

22.1 Scope of Work

This specification is for the grooving of asphaltic concrete on carriageways.

Limits of work shall be marked or defined by the Engineer.

22.2 Grooving

The proposed grooving pattern shall be submitted to the Engineer, for approval, prior to setting out.

Groove width shall be not less than 5mm and not more than 8mm. Groove depth shall be not less than 4mm and not more than 8mm. Spacing shall be at not less than 38mm centres and not more than 50mm centres. No grooves shall deviate more than 15mm from set out lines.

All contaminants shall be intercepted and disposed of in accordance with the requirements of CSS: Part 1 – General.

22.3 Finished Surface

The grooved surface shall be clean, free from staining, dust, sand, grit or any other material associated with the grooving. No slurry material produced from the grooving shall be allowed to dry on the carriageway, especially in new grooves, or in the side channels. All spoil shall be removed from the site.

22.4 Measurement of Work and Basis of Payment

Payment shall be per m² of grooved carriageway, to the nearest m², and shall include setting out of the approved grooving pattern, protection of all sumps, stormwater outlets and service boxes from contamination with the grooving slurry and removal of all material resulting from the grooving.

23.0 EXCESS BITUMEN REMOVAL ON CARRIAGeways

23.1 Scope of Work

This specification is for the removal of excess bitumen by high-pressure waterblasting on chipsealed carriageways.

Limits of work shall be marked or defined by the Engineer.

23.2 Waterblasting

All areas of carriageway with a sand circle diameter greater than 200mm shall be treated. The final treated surface shall have an average sand
circle diameter not greater than 190mm with no sand circles greater than 200mm.

All contaminants shall be intercepted and disposed of in accordance with the requirements of CSS: Part 1 – General.

23.3 Finished Surface

The waterblasted surface shall be clean, free from excess bitumen, sand, grit or any other material associated with the waterblasting. No waste material produced from the waterblasting shall be allowed to dry on or adhere to the carriageway or the side channels. All spoil shall be removed from the site.

23.4 Testing

Sand circle tests to TNZ T/3 shall be carried out at the frequency of not less than one per 30m lane length with a minimum of three sand circles to be carried out on any treated area.

23.5 Measurement of Work and Basis of Payment

Payment shall be per m² of carriageway treated, to the nearest m², and shall include protection of sumps, stormwater outlets and service boxes from contamination with the waste material, removal and disposal of all material resulting from the waterblasting, testing and reinstatement of any road markings affected by the works.

24.0 TRAFFIC SIGNS

24.1 Scope of Work

This specification is for the erection of signs for the control of traffic and the information of road users.

24.2 Regulatory General and Permanent Warning Sign Materials

Traffic signs shall comply with the “Transit New Zealand Manual of Traffic Signs and Markings” and NZS 5414 “Specification for the construction of traffic signs” except where amended below.

All reflectorised surfaces shall be Class 1 High Intensity Prismatic (HIP) 3M retro-reflective sheeting and signs shall be the minimum size specified unless amended below. Fastenings shall not damage or cover the reflective material.

RG 1, 2 and 3 signs shall have a substrate of 2.0mm marine grade 5251 aluminium. RG 1, 2 and 3 signs shall be a minimum of 750mm diameter.
RG 5 and 6 signs shall have a substrate of 2.0mm marine grade 5251 aluminium and be stiffened by two Signfix small channels. The reflectorised surface shall be 3M VIP reflective sheeting.

RG 7 – 26 signs shall have a substrate of 2.0mm marine grade 5251 aluminium and be stiffened by two Signfix small channels.

RP5 signs shall be double sided and the reflectorised surface shall be Class 2 Engineer Grade reflective sheeting. All other RP signs shall be non-reflective. RP signs with a blue background shall be constructed using 3M blue Scotchcal as the background and may be mounted by 6mm diameter bolt, washer and Nylock nut or similar and neoprene washer to protect the sign face.

All PW signs shall have a substrate of 2.0mm marine grade 5251 aluminium and be stiffened by two Signfix small channels. PW 5 signs shall be in accordance with SD 646. All other PW signs shall be a minimum size of 750mm x 750mm with the corresponding supplementary plate size.

PW 29 - 35 signs (vulnerable road users) shall have the background colour ‘fluorescent yellow-green’ and the reflectorised surface shall be 3M VIP reflective sheeting.

Chevron board signs shall have a substrate of 2.0mm marine grade 5251 aluminium and be stiffened by two Signfix small channels. These signs shall be as specified, either to the “Transit New Zealand Manual of Signs and Markings” or in accordance with SD 646.

Double-sided signs (i.e. speed signs) may require external frames allowing them to be either side mounted (to an existing pole) or bottom mounted (to the top of an existing or new post).

The EC film shall be have the symbols cut out of it prior to being placed over the VIP diamond graded sheeting

24.3 Street Name Signs

All street name blades and supplementary street name plates are double sided. The sign layout shall comply with SD 662.

The length of the street name blade shall be determined by the relationship between the number of letters in the street name being fabricated and the number in the “Sample St” sign shown in SD 662.

When modifying the font size to comply with the overall dimensions of SD 662:
The degree of horizontal expansion or contraction shall be uniform within any letter or numeral or any set of characters.

Letter or numeral stroke width shall be reduced or increased within any set of characters in the same proportion as the horizontal reduction or expansion of the character.

Spacings between characters shall be altered in the same proportion as the horizontal alteration.

No expansion or contraction shall exceed 15 percent of the design base letters for character width, stroke width or spacing between characters.

24.3.1 Major Arterial Roads
All street name blades shall have:
Reflective background
Plate depth: 250mm
Style of lettering: Modified Series E, upper and lower case
Size of lettering: 150mm (initial capital)
Style and type of plate: Signfix 250mm Street Name Blade Extra (6063T6)
Type of fixing: Signfix I beam extrusion, complete with mini mounting (OSBMM)
Colour of letters: White VIP Diamond graded sheeting, 3M Scotchlite product, including rectangle as shown in Appendix B
Colour of background: Blue EC film sheeting, 3M Scotchlite product
Colour of plate: Powder-coated Pommel Blue on all exposed surfaces, including fixings

The blue EC film shall have the lettering cut out of it prior to being placed over the VIP Diamond graded sheeting.

24.3.2 Other Streets
All street name blades shall have:
Reflective background
Plate depth: 200mm
Style of lettering: Modified Series E, upper and lower case
Size of lettering: 125mm (initial capital)
Style and type of plate: Signfix 200mm Street Name Blade Extra (6063T6)
Type of fixing: Signfix I beam extrusion, complete with mini mounting (OSBMM)
Colour of letters: White Engineering Grade (Class 2) including rectangle as shown in Appendix B to be constructed in VIP Diamond graded sheeting
Colour of background: Powder-coated Pommel Blue
Colour of plate: Powder-coated Pommel Blue, including fixings
24.3.3 Supplementary Street Name Plates

All supplementary signs shall have:
- Reflective background
- Plate depth: 150mm
- Style of lettering: Modified Series E, upper and lower case
- Size of lettering: 100mm (initial capital)
- Style and type of plate: Signfix 150mm, Street Name Blade Extra (6063T6)
- Type of fixing: Signfix I beam extrusion, complete with mini mounting (OSBMM riveted)
- Colour of letters: White Engineering Grade (Class 2)
- Colour of background: Powder-coated Pommel Blue
- Colour of plate: Powder-coated Pommel Blue

Supplementary signs include “No Exit” and “Private”.

24.4 Fastenings

All RG and PW signs shall be supplied complete including Signfix brackets with 19mm mounting straps, buckles and clips for fixing to metal, concrete or wooden posts.

Street name blades, for fixing to metal posts, shall be supplied fitted with Signfix AUO M6 brackets. Street name blades, for fixing to wooden posts, street light or power poles, shall be supplied fitted with a minimum of two 19mm stainless steel mounting straps, buckles and clips.

24.5 Posts

Wooden posts shall be H4 treated 100mm x 100mm posts, dried to 20–24% moisture content. Posts shall be painted with two coats of white paint.

Steel posts shall be 60.3mm diameter galvanised steel tube with top caps. Steel street name blade posts shall be powder coated white.

Sign posts, except Signfix posts, shall be installed in accordance with SD 647. The post shall be vertical. The excavation for the post shall be restored to the existing construction in accordance with the requirements for that particular type of work.

Signfix posts shall be installed in accordance with SD 635 Detail B, with a ground socket installation depth as specified. The ground socket shall protrude between 30mm – 35mm above the finished ground level.

24.6 Sign Installation

All traffic signs shall conform to “Transit New Zealand Manual of Traffic Signs and Markings Parts I and II” except where otherwise specified in Part 6 Roads.
All signs shall be located where specified. The sign shall be attached in accordance with clause 24.4 - Fastenings.

RG 17 and PW 5 signs shall be mounted on Signfix fluted posts, 60mm diameter, 1.2m long with a top cap and a 400mm ground socket. The posts shall be powder coated white with a hexagonal stainless fixing bolt.

RG 5 and 6 signs shall be mounted as specified on Signfix fluted posts, 76mm diameter, with a top cap and a 400mm ground socket. The posts shall be powder coated white with a hexagonal stainless fixing bolt.

RP signs shall be mounted on 60.3mm diameter galvanised pipe, with a top cap.

Guide Signs shall be installed as specified.

24.7 Removal of Surplus Signs

Surplus signs shall be delivered to the Christchurch City Council Pages Road Store.

All old banding shall be removed.

24.8 Measurement of Work and Basis of Payment

24.8.1 Sign Installation
Payment shall be by lump sum or unit rates as specified and shall include all necessary additional fixings.

24.8.2 Relocation of Signs
Payment shall be by item and shall include all work involved.

24.8.3 Removal of Surplus Signs
Payment shall be by lump sum.

25.0 ROAD MARKING, RAISED PAVEMENT MARKERS, KERB MARKERS AND EDGE MARKERS

25.1 Scope of Work

This Specification is for the installation of pavement markings, raised pavement markers, kerb markers and edge markers on sealed and paved surfaces and kerbs.

25.2 Markings Specification

All road markings shall conform to “Transit New Zealand Manual of Traffic Signs and Markings Parts I and II” except where otherwise specified in Part 6 Roads.
25.3 **Materials**

*Roadmarking paint, raised pavement markers, kerb markers and edge markers shall be approved materials.*

25.4 **Roadmarking**

*Pavement markings shall conform to “Transit New Zealand Manual of Traffic Signs and Markings” except that:*

- centrelines, lane lines, cycle lane lines, edge lines, continuity lines and right turn bay taper lines shall be reflectorised.
- limit lines, holding lines, pavement word messages, flush median bars and right run bay bars shall not be reflectorised.
- where a no stopping restriction exceeds 10m, a 1m stripe, and 2m gap shall be used.
- cycle lane markings shall be as shown on the drawings.
- cycle symbols shall be as shown on SD 661 and SD 663. The scale factor used on paths shall be $X = 35$, resulting in a cycle logo 630mm wide and 980mm high and a scale factor used on roads shall be $X = 50$, resulting in a cycle logo 900mm wide and 1400mm high.

*The installation of roadmarking shall be in accordance with TNZ P/12 except where superseded by SD 641-644 and SD 659.*

*Flush medians shall be marked prior to the construction of traffic islands located within these medians.*

*Intersection ‘Stop’ and ‘Give Way’ marking, and fire hydrants shall be remarked within 24 hours of final surfacing. All other roadmarking shall be remarked within 24 hours of carriageway sweeping where the final surfacing is chipseal or 48 hours of final surfacing otherwise.*

*All roadmarking on newly sealed surfaces shall be remarked between 3 and 6 months after the application of the new seal.*

25.5 **Raised Pavement Markers**

*The installation of raised pavement markers shall conform to TNZ P/14. Markers shall be installed as soon as possible after the construction of the kerbs.*

25.6 **Kerb Markers**

*The installation of kerb markers shall be in accordance with the manufacturer’s requirements. Kerb markers shall be installed with a presentation angle of $90^\circ$ to the approaching traffic and located where specified. Markers shall be installed by the specified time.*

*Refer to standard detail SD 664 or plans for dimensions.*
25.7 **Edge Markers**

The installation of edge markers shall conform to TNZ P/16. Markers shall be installed as soon as possible.

25.8 **Setting Out**

In addition to Clause 9 of TNZ P/12 and Clause 3 of P/14 the Contractor shall obtain the Engineer's approval to the layout and line of the pilot markings before applying paint or markers to the finished surface.

25.9 **Removal of Painted Markings and Pavement Markers**

Chemical removal and blacking out of roadmarking paint is not acceptable.

The disposal of contaminants from the removal of roadmarking paint shall be in accordance with CSS: Part 1 - General.

The Contractor shall repair any damage to the paved surface caused by the removal of paint and pavement markers. Any repairs necessary shall be carried out on the same day that the damage occurred and at the Contractor’s expense.

The Contractor shall remove any redundant pavement markers.

25.10 **Measurement of Work and Basis of Payment**

Where new markings are reflectorised, rates shall include the application of two coats of paint - a first or under coat and a reflectorised second coat.

25.10.1 **Roadmarking**

Payment shall be by lineal metre, to the nearest 0.2m, by m², to the nearest 0.1m², or by item as specified. Dashed line lengths include the gap length.

The rate shall include remarking on new seals in accordance with clause 25.4 – Roadmarking.

25.10.2 **Raised Pavement Markers**

Payment shall be in terms of TNZ P/14.

25.10.3 **Kerb Markers**

Payment shall be per marker and shall include supply and installation.

25.10.4 **Edge Markers**

Payment shall be in terms of TNZ P/16.

25.10.5 **Removal of Road Marking**

Payment shall be by lump sum and include protection of all sumps, stormwater outlets and service boxes from contamination.
with the slurry. It shall also include the disposal of material resulting from the removal and repair of any damage to the paved surface.

25.10.6 Removal of Pavement Markers
Payment shall be by item and include repair of any damage to the paved surface.
## COMPLIANCE REQUIREMENTS CHECKSHEET - ROADING

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## ASPHALTIC CONCRETE PATHS, CROSSINGS AND CYCLEWAYS

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<td>Over 25, over 35 for commercial crossing</td>
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<td>Asphalitic concrete material</td>
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<td>Complies with specification</td>
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<td>Asphaltic concrete joints</td>
<td>Inspect</td>
<td>Right angles to batten or kerb, tack coated, butt joint</td>
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<td>Asphaltic concrete surface</td>
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<td>Pt 6 6.8</td>
<td>Asphaltic concrete surface</td>
<td>Measure</td>
<td>Longitudinal max 5mm gap, cumulative total gap under 10mm for 3m straightedge for cycleways, 20mm otherwise. Transverse max 5mm gap, cumulative total gap under 7mm for 1m straightedge for cycleways, 10mm otherwise.</td>
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### 3 CONCRETE PATHS AND CROSSINGS

<p>| Pt 6 7.2 | Sawcutting | Inspect | All limits sawcut |
| Pt 6 7.2 | Foundations | Inspect | Foundations sound, design CBR achieved |
| Pt 6 7.2 | Foundation materials | Specify | Specify |
| Pt 6 7.3 | Formwork | Inspect | Complies with NZS 3109. Removed before backfilling |
| Pt 6 7.3 | Place formwork | Measure | Within 10mm of design level and location. Max 5mm gap, cumulative total gap under 10mm for 3m straightedge on face |
| Pt 6 7.4 | Concrete materials | NZS 3109 | (N) Normal concrete, 20MPa, 19mm max aggregate |
| Pt 6 7.4 | Concrete materials | Inspect | Polypropylene in commercial crossing concrete |
| Pt 6 7.5 | Concrete depth | Measure | 100mm for paths, 150mm residential |</p>
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<td>U5, constructed with path crossfall</td>
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<td>Created within 24 hours, 3m centres Right angles to kerb</td>
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### 4 GRIFFED PATHS

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<td>Metalcourse surface shape</td>
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5 REPAIRS TO PATHS (WHERE DIFFERENT FROM CLAUSE 6)

| Pt 6 9.2 | Cutting back berms | Inspect | Existing redundant vegetation sprayed fortnight prior |
| Pt 6 9.4 | Metalcourse surface shape | Measure | 20mm below batten or kerb, 30mm if commercial. Max 10mm gap, cumulative total gap under 25mm for 1m straightedge. |
| Pt 6 9.5 | Stormwater repairs | Inspect | Sawcut excavation, complies with CSS Part 3, pipe cleaned out. |
| Pt 6 9.8.2 | Asphalitic concrete resurfacing depth | Measure | 15mm nominal, 10mm min |
| Pt 6 9.11 | Berm restoration | Inspect | Topsoil placed within fortnight of resurfacing |

6 INTERLOCKING CONCRETE BLOCK, COBBLESTONE PAVING AND TACTILE PAVERS

<p>| Pt 6 10.2 | Paving materials | NZS 3116 | Complies with specification |
| Pt 6 10.2.1 | High pedestrian paving materials | Measure | Complies with 10.2.1 |
| Pt 6 | Tactile paving | AS/NZS | Complies with specification |</p>
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<td>Edge treatment location and level</td>
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<td>-5mm, +15mm, ±5mm at edges</td>
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<td>Paving surface level</td>
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### 7 CARRIAGEWAY AND SHOULDER CONSTRUCTION AND REPAIRS

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<td>Subbase metalcourse surface texture</td>
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8 CARRIAGeway MAINTENANCE (WHERE DIFFERENT FROM RELATED CLAUSES)

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<td>Provide quality records</td>
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<td>No binder within 600mm of tree, no damage</td>
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<td>Roadmarking reinstated within 24 hours of sealing or sweeping, as specified</td>
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<td>Spreading equipment</td>
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<td>Applies slurry at specified rate. Spreader box is clean</td>
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<td>Roller</td>
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<td>Minimum weight of 7 tonnes over 7 tyres.</td>
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<td>Slurry conditions</td>
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<td>Temperature above 15°C, will not freeze, or be rained on.</td>
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<td>Surface preparation</td>
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<td>Surface sound, clean</td>
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<td>Finished surface depth</td>
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<td>Trees</td>
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<td>No slurry within 600mm of tree, no damage</td>
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12 PAVING FABRIC

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<td>Pt 6 16.4</td>
<td>Tack coat materials</td>
<td>Inspect</td>
<td>Complies with manufacturer’s specification</td>
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<td>Pt 6 16.4</td>
<td>Tack coat application</td>
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<td>Pt 6 16.4</td>
<td>Fabric installation</td>
<td>Inspect</td>
<td>Complies with manufacturer’s specification. No wrinkles. Laid immediately after tack coat.</td>
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13 LAYING ASPHALTIC CONCRETE ON CARRIAGeways

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<tr>
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<th>TASK</th>
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<th>TEST BY</th>
<th>ACTIONS</th>
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<tr>
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<td>Tack coat application</td>
<td>Inspect</td>
<td>Surface clean</td>
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<td>Pt 6 17.2</td>
<td>Tack coat materials</td>
<td>TNZ M/1</td>
<td>Complies with specification</td>
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<td>Measure</td>
<td>Uniform minimum rate of 0.15 l/m²</td>
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<td>Pt 6 17.3</td>
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<td>Complies with specification</td>
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<tr>
<td>Pt 6 17.3</td>
<td>Asphaltic concrete placement</td>
<td>Measure</td>
<td>Air voids between 2.5% and 6%, 8% on joins. Max layer depth 60mm AC20, 50mm AC16, 30mm AC10.</td>
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<tr>
<td>Pt 6 17.4</td>
<td>Asphaltic concrete joints</td>
<td>Inspect</td>
<td>All uncompleted joints protected over night, cold joints bandaged</td>
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<tr>
<td>Pt 6 17.5</td>
<td>Asphaltic concrete surface</td>
<td>Measure</td>
<td>5mm above fender or kerb, not holding water.</td>
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<tr>
<td>Pt 6 17.5</td>
<td>Asphaltic concrete surface</td>
<td>Measure</td>
<td>Longitudinal max 5mm gap, cumulative total gap under 10mm for 3m straightedge. Transverse max 5mm gap for 1m straightedge.</td>
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<td>Pt 6 17.5</td>
<td>Asphaltic surface</td>
<td>NAASRA</td>
<td>Max 75mm/km, average 55mm/km for new work. Max 90mm/km, 65mm/km overlays</td>
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<tr>
<td>Pt 6</td>
<td>Roadmarking</td>
<td>Inspect</td>
<td>Roadmarking reinstated within 24 hours</td>
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<tr>
<td>Pt 6 17.6</td>
<td>reinstatement</td>
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<td>of sealing or sweeping, as specified</td>
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<td>Pt 6 17.7</td>
<td>Surface boxes adjustment</td>
<td>CSS Part 1</td>
<td>Adjusted as specified, within 72 hours. Fire hydrants always accessible.</td>
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### 14 CARRIAGEWAY SHAPE CORRECTION WITH EMULSION MIX

<p>| Pt 6 18.2 | Emulsion mix material | Inspect | Details provided 7 days before laying. | | | | | |
| Pt 6 18.3 | Tack coat application | Inspect | Surface clean | | | | | |
| Pt 6 18.3 | Tack coat materials | TNZ M/1 | Complies with specification | | | | | |
| Pt 6 18.3 | Tack coat application | Measure | Uniform minimum rate of 0.15 l/m² | | | | | |
| Pt 6 17.3 | Asphaltic concrete placement | Measure | Air voids between 2.5% and 6%, 8% on joins. Max layer depth 60mm AC20, 50mm AC16, 30mm AC10. | | | | | |
| Pt 6 18.4 | Emulsion mix joints | Inspect | All uncompleted joints protected over night | | | | | |
| Pt 6 18.5 | Asphaltic concrete surface | Measure | 0-5mm above fender or kerb | | | | | |
| Pt 6 18.5 | Asphaltic concrete surface | Measure | Longitudinal max 5mm gap, cumulative total gap under 10mm for 3m straightedge. Transverse max 5mm gap for 1m straightedge. | | | | | |
| Pt 6 18.5 | Asphaltic surface | NAASRA | Max 100mm/km, average 75mm/km for &lt;1200 ADT. Max 90mm/km, 70m/km &gt;1200 ADT. | | | | | |
| Pt 6 18.6 | Surplus chip | Inspect | Road swept prior to removal of speed restrictions | | | | | |
| Pt 6 18.7 | Roadmarking reinstatement | Inspect | Roadmarking reinstated within 24 hours of sealing or sweeping, as specified | | | | | |
| Pt 6 | Surface boxes | CSS Part 1 | Adjusted as specified, within 72 hours. | | | | |</p>
<table>
<thead>
<tr>
<th>ITEM</th>
<th>CSS REF</th>
<th>TASK</th>
<th>TEST STD/ DESCRIP</th>
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<td>Asphaltic concrete placement</td>
<td>Measure</td>
<td>Temperature over 10°C.</td>
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<td>Surface clean</td>
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<td>Pt 6 19.3</td>
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<tr>
<td>Pt 6 19.3</td>
<td>Tack coat application</td>
<td>Measure</td>
<td>Uniform minimum rate of 0.15 l/m²</td>
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<tr>
<td>Pt 6 19.2</td>
<td>Asphaltic concrete placement</td>
<td>Measure</td>
<td>Air voids between 2.5% and 6%, 8% on joins. Max layer depth 60mm AC20, 50mm AC16, 30mm AC10.</td>
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<td>Pt 6 19.4</td>
<td>Asphaltic concrete joints</td>
<td>Inspect</td>
<td>All uncompleted joints protected over night</td>
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<tr>
<td>Pt 6 19.5</td>
<td>Asphaltic concrete edge treatment</td>
<td>Inspect</td>
<td>Fender treated in accordance with SD 617 Materials and placement complies with Part 6 clause 17.</td>
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<td>Pt 6 19.6</td>
<td>Permanent ramps</td>
<td>Inspect</td>
<td>Joint vertical, straight. Ramp keyed into existing surface</td>
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<tr>
<td>Pt 6 19.6</td>
<td>Permanent ramp placement</td>
<td>Inspect</td>
<td>0-5mm above fender or kerb</td>
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<tr>
<td>Pt 6 19.7</td>
<td>Asphaltic concrete surface</td>
<td>Measure</td>
<td>Longitudinal max 5mm gap, cumulative total gap under 10mm for 3m straightedge. Transverse max 5mm gap for 1m straightedge.</td>
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<tr>
<td>Pt 6 19.7</td>
<td>Asphaltic concrete surface</td>
<td>Measure</td>
<td>Max 75mm/km, average 55mm/km for new work. Max 90mm/km, 65mm/km</td>
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**CARRIAGEWAY SMOOTHING WITH POROUS ASPHALT**
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<td>Roadmarking reinstatement</td>
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<td>16</td>
<td>PAVEMENT CRACKFILLING</td>
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<td>Pt 6 20.2</td>
<td>Crackfilling materials</td>
<td>Measure</td>
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<td>Pt 6 20.3</td>
<td>Surface preparation</td>
<td>Inspect</td>
<td>Cracks clean and dry, under 5mm width</td>
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<td>Pt 6 20.4</td>
<td>Crackfilling application</td>
<td>Inspect</td>
<td>Sealant hot, bandage 100mm wide, 2mm thick, sanded</td>
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<td>Pt 6 20.5</td>
<td>Maintenance</td>
<td>Inspect</td>
<td>Swept within 48 hours</td>
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<td>COLD MILLING</td>
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<td>Pt 6 21.2</td>
<td>Milling process</td>
<td>Inspect</td>
<td>Waste water controlled, waste removed</td>
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<td>Pt 6 21.2</td>
<td>Milling process</td>
<td>Inspect</td>
<td>Backfilled edges vertical, edges protected overnight</td>
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<td>Pt 6 21.3</td>
<td>Finished surface</td>
<td>Measure</td>
<td>0m, +5mm specified depth. Max 5mm gap longitudinal for 3m straightedge, transverse for 1m straightedge.</td>
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<td>18</td>
<td>GROOVING</td>
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<td>Pt 6 22.2</td>
<td>Grooving pattern</td>
<td>Inspect</td>
<td>Approved prior to work</td>
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<td>Pt 6 22.2</td>
<td>Grooving process</td>
<td>Measure</td>
<td>Width 5-8mm, depth 4-8mm. Spacing 38-50mm. Grooved within 15mm of set out lines.</td>
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<td>Finished surface</td>
<td>Inspect</td>
<td>Clean of dust and slurry</td>
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<td>Waterblasting area</td>
<td>TNZ T/3</td>
<td>Max sandcircle 200mm, average 190mm</td>
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<td>Pt 6.23.2</td>
<td>Waterblasting process</td>
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<td>Waste water controlled, waste removed</td>
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<td>Pt 6.23.3</td>
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<td>Inspect</td>
<td>Clean of dust and spoil</td>
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<td>RG and PW sign materials</td>
<td>NZS 5414, TNZ manual</td>
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<td>Street sign materials</td>
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<td>Pt 6.24.5</td>
<td>Post materials</td>
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<td>Pt 6.24.5</td>
<td>Post installation</td>
<td>Inspect</td>
<td>Signfix posts to SD 635, other posts to SD 647</td>
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<td>Sign installation</td>
<td>TNZ manual</td>
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<td>Pt 6.24.6</td>
<td>Sign installation</td>
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<td>Surplus signs</td>
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<td>Old signs and banding removed</td>
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<td>Pt 6 25.2</td>
<td>Marking layout</td>
<td>TNZ manual, CSS</td>
<td>Complies with specification</td>
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<td>Pt 6 25.3</td>
<td>Roadmarking materials</td>
<td>Inspect</td>
<td>Materials comply with ‘approved materials’ list</td>
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<td>Pt 6 25.4</td>
<td>Roadmarking installation</td>
<td>TNZ P/12, SD 659, 641-644</td>
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<td>Pt 6 25.4</td>
<td>Cycle roadmarking installation</td>
<td>TNZ P/12, SD 650, 663, 661, 663</td>
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<td>Roadmarking installation</td>
<td>Inspect</td>
<td>Flush medians painted before traffic islands constructed</td>
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<td>Pt 6 25.5</td>
<td>RPM installation</td>
<td>TNZ P/14</td>
<td>Complies with specification, installed asap</td>
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<td>Pt 6 25.6</td>
<td>Kerb marker installation</td>
<td>SD 664</td>
<td>Complies with manufacturer’s specifications, at right angle to traffic, where specified and by specified time</td>
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<td>Edge marker installation</td>
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<td>Set out</td>
<td>Inspect</td>
<td>Approval gained before marking or installation</td>
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<td>Pt 6 25.9</td>
<td>Marking and marker removal process</td>
<td>Inspect</td>
<td>Removal complete, damage repaired</td>
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</tr>
<tr>
<td></td>
<td>Pt 6 25.9</td>
<td>Paint removal process</td>
<td>Inspect</td>
<td>Waste water controlled, waste removed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Asphaltic Concrete Path, Grass Berm or Landscape area. Top of Kerb sloped 10mm. Kerb Levels on Plan given to this Point.

75mm Extra Concrete Base with 2 D12 Bars where directed, eg: at Bus Stops, Corner Roundings etc.

Kerb & Flat Channel

Notes:
1. Concrete strength to be 20MPa at 28 days.
2. Concrete Finish to conform with Class U3 of NZS3114.
3. Limits of excavation to be sawcut if path and/or carriageway is not to be reconstructed.

Back of Path and Interpath Channel
NOTES:
1. Concrete strength to be 20MPa at 28 days.
2. Concrete finish to conform with Class U3 of NZS3114.
3. Limits of excavation to be sawcut if path and/or carriageway is not to be reconstructed.
4. Kerb entry adaptors shall not to be installed in low profile Kerb & Channel.
Min. 15mm Mortar. 

Existing Carriageway. 

Base for Laying on Reconstruction. 

Base for Carriageway 15 0 or 18 0 as Specified. 

Road Surface 

PRECAST MOUNTABLE MEDIAN KERB BLOCKS 

Kerb levels on Plan given to this point. 

Min. 15mm Mortar. 

Kerb Face 

Kerb levels on Plan given to this point. 

Kerb Face 

Base for Laying on Existing Carriageway. 

Base for Carriageway Reconstruction. 

IN SITU MOUNTABLE MEDIAN KERB 

Notes:
1. Concrete Strength to be 20MPa at 28 days.
2. Concrete Finish to Conform with Class U3 of NZS3114.
3. Length of Precast Block 600mm.

LOW MOUNTABLE KERB 

2-D12 and R6-600
HILLSIDE CHANNEL

NOTES:

1. Concrete strength to be 20 MPa at 28 days.
2. Concrete Finish to conform with Class U3 of NZS3114.

Vehicle crossing for HILLSIDE CHANNEL

Area of waterway: 0.04 m²

Area of concrete: 0.11 m²

Bed in and ramp existing road surface with asphaltic concrete.

Kerb levels on Plan given to this point.

Three M12 75mm long Dynabolt masonry anchors per plate with 70mm concrete cover.

- 600 nominal x10x1.2m long checker plate covers.
- Position to suit driveway gradient. On curves cut plates so they butt join at ends.

Area of masonry anchors per plate as shown on Plan given to this point.

Theoretical kerb face.
NOTES:
1. Stormwater Outlets in kerbs to be at 200mm centres minimum.
2. Kerb entry adaptor to be installed in conjunction with the pouring of the kerb and channel.
3. If kerb entry adaptor is installed after concrete has hardened then kerb is to be cut on slope as shown in detail 1 above.
1. Crossing locations and widths to comply with current City Plan.
2. Where two crossings in Kerb & Dish Channel are within 1m of each other they shall be joined to form one continuous crossing and a cleaning opening shall be installed centrally to the crossing.
3. Where two crossings in Kerb & Flat channel are separated by up to 1m of full height kerb, they shall be joined to form one continuous crossing.
4. Minimum width of Vehicle Crossing to be 3.5m.
5. Batten to be laid to top of cutdown shoulder when residential crossing is adjacent to landscaping or cobblestones.

NOTES:
FOOTPATH CONSTRUCTION

NOTES:
1. Crossfall to be nominally 2.0% (min 1.25%, max 3.0%) or as shown on the plans.
2. Battens not required where metal course contained by concrete kerbs or concrete foundations.
3. Subgrade and metal course to be treated with soil sterilant.
4. Existing sealed paths and drives to be sawcut at limits of new paths.
5. TNZ M/10 : AC10 is an acceptable alternative surfacing for the vehicle crossing.

RESIDENTIAL CROSSING

COMMERCIAL CROSSING
FOOTPATH CONSTRUCTION

NOTES:
1. Crossfall to be nominally 2.0% (min 1.25%, max 3.0%) or as shown on the plans,
2. Existing sealed paths and drives to be sawcut at limits of new paths,
3. Construction Joints to be formed at maximum 3.0m centres,
4. All formwork to be removed.

RESIDENTIAL CROSSING
1. Crossfalls to be nominally 3.0% (Crowned or continuous crossfalls as specified).
2. Subgrade & metal course to be treated with approved soil sterilant.
3. Pegs to be at least 5mm below battens adjacent to grass and 25mm below battens adjacent to landscape areas.
NOTES:
1. Reinforcement 4-D12 and R6-600.
2. Reinforcement beam to extend 1.5m from base of cutdown at each end.
3. Concrete to be 20MPa at 28 days.
4. Concrete finish on exposed faces to conform with Class U3 of NZS3114.

Concrete finish on exposed faces to conform with Class U3 of NZS3114.

Reinforcement beam to extend 1.5m from base of cutdown at each end.

Concrete to be 20MPa at 28 days.

Concrete finish on exposed faces to conform with Class U3 of NZS3114.
Straight edge

Type A

NOTES:
1. All concrete 35 MPa.
2. 6-D12 reinforcing bars and 2-R6 at 300.

Type B

STANDARD PRECAST CHANNEL COVERS
475mm x 500mm, 450mm x 500mm & 425mm x 500mm

Channel Cover

Typical existing shoulder.
Mortar joint (crossing blocks to be true to grade)

RESIDENTIAL

Asphaltic concrete TNZ M/10:AC10 ramp. Ramp not to extend more than 500mm without the Engineer's approval

Existing standard
Dish Channel

Invert same as invert of existing channel (approval needed for any variation)

NOTES:
1. All concrete 20 MPa at 28 days.
2. Reinforcement 4-D12 R6-600
3. TNZ M/10:AC10 is an acceptable alternative surfacing for the vehicle crossing.
4. Refer to SD606 for ramp dimensions.

COMMERCIAL

DISH CHANNEL
VEHICLE CROSSINGS

Christchurch City Council

ISSUE DATE | MAR 2013
SD612
SHEET 1
BATTEN LOCATION AT KERB

NOTE:
1. To be used for all pedestrian & cycle cutdowns.
2. Maximum gradient of path to be 8%, utilizing the maximum gradient of C3/2. Detail C, when continuity of path is required.
3. Landscape or Cobbles to be used as specified.

Normal path crossfall 3% Continuous grade through to channel

Normal Path Crossfall 5% Normally 3% Off

PeDESTRIAN AND CYCLEWAY CUTDOWN

Christchurch City Council

ISSUE DATE: MAR 2013

SD613 SHEET 1
NOTES:

1. Cross sectional area of swale crossing to equal specified area of swale.
2. Invert of swale must not change from specified.
NOTES:
1. Crossing locations and widths to comply with current City Plan.
2. Where two crossings are within 1m of each other they shall be joined to form one continuous crossing.
3. Vehicle Crossing Width to be minimum 3.5m.
**TYPE A**

Note:

1. Where the existing underlying material is not granular.

**TYPE B**

Note:

1. Where the existing underlying material is granular.
Grind face of elbow to slope of handrail before welding.

Lace netting to top rail with high tensile wire.

Partial flatten top of post and weld to rail.

Tie post to netting with lacing wire at mid height.

50mm N.B. galv medium post.

Top of concrete - slot through Strainer bar.

B.O.P. level (Type C). (Types A and B)

Top of concrete (Types A and B). B.O.P. level (Type C).

Offset bands

Wire strainer (offset band at other end)

Strainer bar - slot through netting.

35mm black plastic coated chain link netting (2.8mm internal core).

Galv. spiral strainer wire - tie to netting with wire clips at 300 c/c

Tie post to netting with lacing wire at mid height.

50mm N.B. galv medium post.

Split selvedge - slot through netting.

Weld elbow to post and top tail.

Recess filled with 2:1 sand/cement mortar.

Concrete capping beam

Culvert headwall or similar.

Crib units

20 MPa concrete collar.

200x50 walings or 150 half rounds.

2.000 c/c

Before welding.

SD621

ISSUE DATE DEC 2009

PEDESTRIAN SAFETY FENCE

SD621

SHEET 1
NOTE:
1. Concrete Strength to be 20 MPa at 28 days
NOTES:
1. Carriageway camber on either side of offset crown should be balanced in terms of the above camber tables.
2. Where the road width is under 9m and designed with a single crossfall, construct with a straight grade from fender to fender.
CYCLE STAND DETAIL - TYPE A

150mmR Max.
Galv. Pipe
50mm OD

250Φ Concrete Surround

100

D20

900

700

600

480

270

900

600

100

250Φ Concrete Surround

D20

Galv. Pipe
50mm OD

CYCLE STAND DETAIL - TYPE B

SD624

Christchurch City Council

cyclestands
Typical Road Cross Section

- Path, berm, or vehicle crossing
- 150mm
- Underchannel pipe
- Concrete surround
- Geotextile to extend 300mm up side of Concrete surround
- Geotextile or Geogrid where specified
- Basecourse as specified
- Subbase course as specified
- Surfacing as specified

RS062601A

Christchurch City Council

TYPICAL ROAD CROSS SECTION

SD625

ISSUE DATE: FEB 2002
1.4m WHEEL STOPS

- 300x300x400, 17.5MPa concrete anchor blocks.
- 150mm timber wheel stop
- M12 Bolt
- 300mm

2.0m WHEEL STOPS

- 300x300x400, 17.5MPa concrete anchor blocks.

Concrete top to be squared off with a flat troweled surface & 5mm chamfer to edges.
ROAD HUMP DETAILS

SD631

Note:
1. The Surface of the Compacted Asphalt shall at no point vary more than 5mm from the Standard Profile laid Longitudinally over the Road Hump.
2. Refer to SD641 for roadmarking details.
NOTES:

1. Colour of cobblestones to be as specified.
2. See SD 607 for footpath construction details.
3. Concrete Strength to be 20MPa at 28 days.

COBBLESTONES ADJACENT TO FOOTPATH

COBBLESTONES ADJACENT TO PLANTING/BERM

NOTES:

1. Colour of cobblestones to be as specified.
2. See SD 607 for footpath construction details.
3. Concrete Strength to be 20MPa at 28 days.
**NOTES:**
1. Colour of Interlocking Conc. Blocks to be as specified
2. Concrete strength to be 20MPa at 28 days
3. Exposed concrete finish to conform with class U3 NZS 3114

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**INTERLOCKING CONCRETE BLOCK EDGE TREATMENTS**

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**SD634**

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**SD634**
PEDESTRIAN ISLAND WITH 1.5m CROSSING

Concrete Nosing to SD635/2 Detail 'A'

RG17 'Keep Left' HIP reflectivity sign 2.0m from nose to SD635/2 Detail 'B'

Mountable Median Kerb to SD603

Concrete Nosing to SD635/2 Detail 'A'

Surfacings as specified Autumn Tone Cobbles (stretcher bond pattern) or Autumn Tone Coloured Concrete (stretcher bond pattern pressed in)

Yellow Monodirectional Kerb Top Markers positioned as shown

Tactile paving layout where specified

NOTES:
1. Concrete strength to be 20MPa at 28 days.
2. Concrete finish to conform with Class U3 of NZS3114.
3. Concrete strength to be 20MPa at 28 days.

PEDESTRIAN ISLAND WITH 3.0m CROSSING

1.8m ISLAND
15.0m ISLAND
12.0m ISLAND
9.0m ISLAND
18.0m ISLAND
15.0m ISLAND
12.0m ISLAND
9.0m ISLAND
0.05m
10°

Holding Rail to SD635/2 Detail 'C'

Yellow Monodirectional Kerb Top Markers positioned as shown

Tactile paving layout where specified

NOTES:
1. Concrete strength to be 20MPa at 28 days.
2. Concrete finish to conform with Class U3 of NZS3114.
3. Concrete strength to be 20MPa at 28 days.

PEDESTRIAN ISLAND WITH 1.5m CROSSING

Concrete Nosing to SD635/2 Detail 'A'

RG17 'Keep Left' HIP reflectivity sign 2.0m from nose to SD635/2 Detail 'B'

Mountable Median Kerb to SD603

Concrete Nosing to SD635/2 Detail 'A'

Surfacings as specified Autumn Tone Cobbles (stretcher bond pattern) or Autumn Tone Coloured Concrete (stretcher bond pattern pressed in)

Yellow Monodirectional Kerb Top Markers positioned as shown

Tactile paving layout where specified

NOTES:
1. Concrete strength to be 20MPa at 28 days.
2. Concrete finish to conform with Class U3 of NZS3114.
3. Concrete strength to be 20MPa at 28 days.
Notes:
1. Where sign is installed in landscape areas, the concrete foundation depth shall be increased by 300mm.
2. Holding rail to be made from 40 NB medium Galv. Pipe then powder coated with Orica 288 96905, Dough Safety Yellow.
3. Yellow retroreflective strips required on holding rails within pedestrian islands only.
4. Yellow retroreflective strip to TNZ M/14 to be applied to holding rail on side closest to oncoming traffic.
5. Where holding rail installed in pairs, retroreflective strips are required on outside faces only.
NOTE:
1. Centreline to be marked only where specified.
2. Roadmarking paints to be approved.
3. Refer to SD631 for road hump construction details.
4. Refer to SD634 for platform construction details.

WHITE 150mm WIDE THERMOPLASTIC PAINT

REINFORCED CONCRETE SEPARATING STRIP IF REQUIRED

AC SURFACING

PATTERNED SURFACE AS SPECIFIED

100MM REFLECTORISED WHITE

1.85m MAX 1.85m MAX 1.85m MAX 1.85m MAX

KERB & FLAT CHANNEL

WIDTH AS SPECIFIED

PLATFORM

ROAD HUMP

1. Centreline to be marked only where specified.
2. Roadmarking paints to be approved.
3. Refer to SD631 for road hump construction details.
4. Refer to SD634 for platform construction details.

WHITE 150mm WIDE THERMOPLASTIC PAINT

REINFORCED CONCRETE SEPARATING STRIP IF REQUIRED

AC SURFACING

PATTERNED SURFACE AS SPECIFIED

100MM REFLECTORISED WHITE

1.85m MAX 1.85m MAX 1.85m MAX 1.85m MAX

KERB & FLAT CHANNEL

WIDTH AS SPECIFIED

PLATFORM

ROAD HUMP

1. Centreline to be marked only where specified.
2. Roadmarking paints to be approved.
3. Refer to SD631 for road hump construction details.
4. Refer to SD634 for platform construction details.
NOTES:
1. Bus Stop, Loading Zone and Taxi Stand markings similar, Stripes 1.0 x 0.1 wide with 1.0 gaps.
2. Where a cycle lane is marked adjacent to a bus stop, reduce the bus stop width to 2.5m and mark a 1.2m min cycle lane alongside.
STANDARD CCC ROUNDBAOUT CHEVRON / NAME BOARD

NOTE:
1. All dimensions are in millimetres (mm) unless otherwise stated.
2. No obstructions or landscaping in front of signs.
NOTE:

1. All dimensions are in millimetres (mm) unless otherwise stated.
**POST STANDARD INSTALLATION DETAIL**

**GALVANISED PIPE OR SIGNFIX POST INSTALLATION DETAIL**

- **Top cap.**
- **Supplementary Sign as specified**
- **Concrete post foundation.**
- **Anti Twist Bars for galvanised post only**
- **2700 to base of lowest sign min.**
- **825 mm**
- **25 mm**
- **60.3mm O.D. galvanised pipe or Signfix post in ground socket to SD635**

**WOODEN POST INSTALLATION DETAIL**

- **Top cap.**
- **Supplementary Sign as specified**
- **Concrete post foundation.**
- **2700 to base of lowest sign min.**
- **500 mm**
- **25 mm**
- **100x100 H4 Treated Timber Post painted white**

**REGULATORY PARKING SIGNS DETAIL**

- **Top cap.**
- **Supplementary Sign as specified**
- **Concrete post foundation.**
- **2100 to base of lowest sign min.**
- **25 mm**
- **60.3mm O.D. galvanised pipe or Signfix post in ground socket to SD635**

**NOTE:**

1. All dimensions are to underside of lowest sign unless otherwise stated.
2. Where parking signs exceed 450mm width increase height as specified.

---

**SIGN DETAIL**

- **No Exit**
- **Sample St**
- **2500 to lowest sign**
- **2700 to lowest sign**
- **825 mm**
- **25 mm**
- **100x100 H4 Treated Timber Post painted white**

**ISSUE DATE**

- **DEC 2009**

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**Street Name Blades**

- **Parking**
- **2100**
- **2700**
- **All other signs**
- **2300**
SAFE ROUTES TO SCHOOL SIGN

SECTION A-A

Notes:
1. Main sign structure to be made from 40 NB medium hot dipped galv pipe then after manufacture, powder coated with "Western chemical 0021 hot chilli".
2. Concrete to be 20 MPa.
3. Where sign is installed in landscape areas, the concrete foundation depth shall be increased by 300mm.

3mm Aluminium powder coated yellow. Dulux 2037 lemon yellow

Screen print graphics and type black & white

25mm square section steelwelded. Galv & powder coat with main sign structure
NOTES:
1. To be white on approach left hand side, and yellow on approach right hand side.
2. Ensure post is founded in solid bearing.
3. To be mounted back-to-back where specified.

1. Ensure post is founded in solid bearing
NOTES:

1. Absolute minimum of 1.7m for cycle lane next
to parking lane. Dashed minimum width 1.8m.
   (For 50 km/hr Speed Limit)
2. Cycle Logos to SD661 in locations as shown.
   All other mid-block cycle logos evenly spaced
   with maximum spacing of 100m.
NOTES:
1. Without kerb build-outs, the minimum length of broken yellow ‘No Stopping’ lines on the approaches to pedestrian crossings is 15m.
2. Christchurch City Council the dimension amendments to the Manual of Traffic Signs & Markings issued by the NZTA.
3. Broken yellow No Stopping line stripes at 2.0 centres 1.0 x 0.1 wide for lengths over 15m. Pedestrian crossing stripes at 900 centres 5.0 x 0.3 wide.
"Give Way" Sign

Bike symbol where specified

Signfix Fluted Post

Signfix Ground Socket

Socket

Ground

Fluted Post

Capped pole

450

100

30-35mm

1570

400

200

392

50

300

SD660

CYCLE GIVEWAY & SUPPLEMENTARY SIGN
1. Road markings to be reflectorised white.

2. This is the NZTA Manual of Traffic Signs & Markings Part II Cycle Symbol.
   On paths use a scale factor of X=35mm, resulting in a cycle logo 630mm wide & 980mm high.
   On roads use a scale factor of X=50mm, resulting in a cycle logo 900mm wide & 1440mm high.

NOTE:

<table>
<thead>
<tr>
<th>Spacing</th>
<th>As specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersections</td>
<td>As specified</td>
</tr>
<tr>
<td>Midblock - Typical</td>
<td>50m</td>
</tr>
<tr>
<td>Midblock - Low Conflict</td>
<td>100m</td>
</tr>
</tbody>
</table>
Font for signage lettering to be "Modified Series E uncondensed".

NOTES

1. Lettering dimension applies to "Sample St" only. Dimension will increase or decrease with greater or lesser number of letters in street name.

2. Font for signage lettering to be "Modified Series E uncondensed".
NOTES:
1. Hook turn box sides to be at least 1.5m long.
Minimum of four Kerb top markers spread evenly over kerb displacement with a maximum 1.0m spacing.
CHRISTCHURCH CITY COUNCIL
CONSTRUCTION STANDARD SPECIFICATION

PART 7 – LANDSCAPES

CSS: PART 7 2013

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## APPENDICES

1. Landscape Construction Monthly Establishment Report
2. Compliance Requirements Checksheet

## STANDARD DETAILS

### Tree Staking and Root Barriers

- **SD 701** detail deleted Revision 7.0
- **SD 702/1** Vertical Tree Staking – Street Trees
- **SD 702/2** Vertical Tree Staking – Reserve Trees
- **SD 703** Square Tree Staking
- **SD 704** Tree Root Barrier
- **SD 730** Hard Surface Tree Pit

### Tree Grates and Guards

- **SD 705** Small Tree Grate
- **SD 706** Large Tree Grate
- **SD 707/1** Tree Guard
- **SD 707/2** Tree Guard Base for Small Tree Grate
- **SD 707/3** Tree Guard Base for Large Tree Grate
- **SD 708** Footpath Grate Foundation
- **SD 709** Kerbside Grate Foundation
- **SD 710** Minor Grate Foundation

### Structures

- **SD 711/1,2** Standard Park Bench
- **SD 712** Park Bench Installation
- **SD 713** U-Bolt Concrete Litter Bin Fixing
- **SD 714** Post and Cable Fence
- **SD 715** Post and Chain Fence
- **SD 716** Park Entrance
- **SD 717** Standard Picnic Table
- **SD 718** detail deleted Revision 3.0
- **SD 719** Dog Bowl Base with e-mac Drinking Fountain and Bottle Filler
- **SD 720** Bus Stop Seat
- **SD 735** High Volume Central Bollard and Markings
- **SD 736** Shared Pathway Sign
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<th>Plant Bed Formation</th>
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1.0 FOREWORD

This Specification forms Part 7 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the following Parts:

CSS: Part 1 2013 - General
CSS: Part 2 2013 - Earthworks
CSS: Part 3 2013 - Utility Drainage
CSS: Part 4 2013 - Water Supply
CSS: Part 5 2013 - Lights
CSS: Part 6 2013 - Roads
CSS: Part 7 2013 - Landscapes

Part 7 of the Standard Specification includes those Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

NZS 4680:2006 Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
NZS 3602:2003 Timber and wood-based products for use in building
AS/NZS 4787:2001 Timber - Assessment of drying quality
AS 4373: 2007 Pruning of amenity trees
BS 3998: 2010 Tree work. Recommendations
BS 4043: 1989 Recommendations for transplanting root-balled trees
BS 5837: 2012 Trees in relation to design, demolition and construction. Recommendations
3.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means approved by the Engineer unless otherwise specified.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

Selected materials are specified in CSS: Part 1 - General.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

4.0 SUPPLY OF TREE AND PLANT MATERIALS

4.1 Scope of Work

This specification is for the supply of tree and plant materials.

4.2 Tree and Plant Materials

All tree and plant material shall be nursery stock, true to name and type. Roots shall not be left exposed.

4.2.1 Crown

All trees and plants supplied shall:

- Show no mineral deficiencies or chemical or frost damage.
- Be free of pests and diseases.
- Have good vigour and vitality and form.
- Have a crown/root ratio of reasonable proportions.
- Be hardened off thereby ensuring immediate establishment upon planting.
- Have a sound structure.

4.2.2 Roots

Roots are important to a tree or plant’s establishment and continued growth. To ensure the optimum opportunity for survival all trees and plants shall:

- Be free of decay.
- Be weed free.
- Have no damaged roots (pruning shall be carried in accordance with accepted horticultural standards).
- Have a two month supply of nutrients.
- Have a reasonable moisture content.
- Be conducive to a successful transplant.
- Have a root/crown ratio of reasonable proportions.
- Have a solid root ball with roots holding the mix together firmly (i.e. not prone to disintegration or recently bagged on).
- Have an even 360° spread.

4.2.3 Stem
All trees and plants supplied shall:
- Have no damage either mechanical, insect or disease.
- Be firm and upright in the pot.
- Have a sound structure.

4.2.4 Trees
Trees shall have sturdy, clean, straight, stems. Evergreen trees shall be individually wrapped. All root balls shall be contained in moisture retentive material.

Open ground trees shall be lifted at the nursery with minimum damage to the roots and with maximum retention of roots. Open ground trees shall have as much soil as possible retained around the root ball.

<table>
<thead>
<tr>
<th>Average Height Range (m)</th>
<th>Minimum Calliper (mm)</th>
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<tbody>
<tr>
<td>1.5-1.8</td>
<td>15</td>
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<tr>
<td>1.8-2.5</td>
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<tr>
<td>2.5-3.0</td>
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</tr>
<tr>
<td>3.0-3.6</td>
<td>40</td>
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<tr>
<td>3.6-4.2</td>
<td>60</td>
</tr>
<tr>
<td>4.2-4.8</td>
<td>80</td>
</tr>
<tr>
<td>4.8-5.5</td>
<td>100</td>
</tr>
<tr>
<td>5.5+</td>
<td>130</td>
</tr>
</tbody>
</table>

Trees will be specified using the above measurement ranges. The calliper measure is taken at 150mm above the ground for trees up to 100mm calliper size and 300mm above the ground for larger trees.

4.2.5 Shrubs and Groundcovers
Container size and type shall be as specified, e.g. PB5. Shrubs and groundcovers shall be strong, well rooted and have a good bushy form.
4.2.6 ‘Wetland’ Plants
Container size and type shall be as specified. They shall be supplied as well rooted plants in containers, i.e. pots, root trainers or polythene bags.

4.2.7 Revegetation Plants
Container size and type shall be as specified.

4.3 Measurement of Work and Basis for Payment

Supply of tree and plant materials shall be paid at the individual rate for the specified size.

5.0 TRANSPORT OF TREE AND PLANT MATERIALS

5.1 Scope of Work

This specification is for the transportation and storage of plant materials.

5.2 Supply and Collection

*Trees and plants shall be handled with care at all times, lifted by the container and placed on the ground or into vehicles. Trees or plants shall not be substituted without the Engineer’s approval.*

Tree and plant materials shall be supplied by the Christchurch City Council’s nursery, unless otherwise specified. Where supplied by the Christchurch City Council, they have been pre-ordered and can be collected from the Linwood Nursery in Smith Street. Open ground trees are usually available between 1 June and 31 August subject to seasonal conditions. Open ground (bare root stock) and container trees, e.g. PB95, can be collected from the Harewood Nursery at 239 Gardiners Road. The collection location for other suppliers will be specified.

The Contractor shall advise the nursery of the intended pick-up date for the trees and plants at least five working days in advance (contact Christchurch City Council Nursery Supervisor, business hours, at telephone 381-2499, fax 381-2503 or other supplier as specified). The Contractor shall give twenty-four hours notice of the intended time of pick-up.

The Contractor shall check the trees and plants at the nursery at the time of collection and, if they are not considered to be of a suitable standard, shall inform the Engineer.

It is the Contractor’s responsibility to ensure trees and plants are thoroughly watered before they are transported from the nursery. Once
trees and plants leave the nursery they are the responsibility of the Contractor.

5.3 Transportation and Storage

All tree and plant material shall be carefully packed and protected during transport to the site to prevent damage. Foliage shall be protected from desiccation during transportation. Black polythene shall not be used for this. Container grown plants shall not be bundled together.

Plant roots shall be protected at all times from drying out. Bare rooted plants, such as trees, shall have individual root balls contained in moisture retentive material.

Trees and plants shall be planted within 48 hours of delivery. The Engineer shall be informed where this is not achieved. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected, sheltered and the soil kept well watered.

If damage occurs the trees or plants shall be replaced at the Contractor’s expense.

Pots and other protective materials shall not be removed until immediately prior to planting, and shall be disposed of off the site after planting. Plastic pots may be returned to the Christchurch City Council’s nursery for reuse.

5.4 Measurement of Work and Basis for Payment

Collection, transportation and storage of tree or plant materials shall be included in the rate for planting.
6.0 PLANTING OF SPECIMEN TREES

6.1 Scope of Work

This specification is for site preparation, setting out, planting, fertilising and establishment of specimen trees.

6.2 Timing

Planting shall generally take place between 1 April and 30 September (the planting season). The final planting date for bare root stock is 1 September. Planting may occur outside these times with the approval of the Engineer.

The Contractor shall carry out the works to protect the existing subsoil and prevent soil structural damage.

6.3 Setting Out

Planting positions shall be in accordance with the planting plans.

The Engineer may require minor refinement to the design with adjustments to lines, levels and grouping of trees locally as the planting proceeds. The Contractor shall cooperate with this.

In areas of block planting, plants shall be spaced so that when established they will completely and evenly fill the areas indicated, unless otherwise specified. The extent of the area to be filled by each species shall first be defined with plants spaced around the perimeter. The remaining plants shall then be used to fill the centre of the area in an informal manner avoiding straight lines and regular geometric patterns, unless otherwise specified.

6.4 Container Trees

*Containerised trees shall be thoroughly moistened at the time of planting. If the soil is dry, the plant shall be submerged in water for five minutes until air bubbles stop rising. Allow time to drain before planting.*

Balled and container grown plants shall have the cloth cordage, container, wire containment and hessian removed immediately prior to planting. Care shall be taken to ensure that the root ball is not disturbed during container removal or planting.

If plants are slightly potbound the roots shall be loosened, trimmed and spread out to ensure healthy growth. Roots shall not be exposed to the sun or wind.
6.5 Transplanted Trees

Transplanted trees shall be handled in accordance with BS 4043 “Recommendations for transplanting root-balled trees”.

6.6 Tree Pit

Tree pits shall be three times the size of the root ball to be planted, with a minimum depth of 1.5 times the depth of the root ball. The bottom of the pit shall be forked over to an additional depth of 300mm to facilitate root penetration, air movement and free drainage. See SD 702 sheets 1 or 2 for installation details.

6.7 Planting

Trees shall be set upright in the centre of the pit at such a depth that the soil, when firmed down, is at the same height as the top of the root ball. Soil shall be heeled in using natural body weight and not compacted by machinery or ‘stamped’ down. Any major roots that accidentally break off or fray shall be cleanly cut off flush with the root ball using sharp secateurs or a handsaw.

Where roots are pot bound and/or girdling they shall be cleanly severed at the edge of the root ball and gently teased out in a radial fashion.

Loose roots shall be spread out in a radial fashion and the pit progressively backfilled with first class topsoil, carefully placed under and amongst them to fill all voids and consolidated so that no air pockets are present and the tree is firmly held. For bare root stock the soil shall be heeled firmly round the root collar.

The Engineer may approve the use of excavated material for backfilling. Where an auger or other mechanical method is used to excavate the tree pit, the sides of the excavation shall be scarified before planting.

Each tree shall be watered thoroughly after planting, ensuring that the moisture has penetrated to the full depth of the root ball (initial watering is also important to settle the soil around the roots).

Unless otherwise specified, all newly planted trees shall be staked and mulched in accordance with clauses 8.0 - Mulching and 9.0 – Staking Trees and Shrubs.
6.8 Establishment

Works to achieve establishment of the trees shall be carried out by the Contractor, in accordance with clause 14.0 - Establishment. This will mainly consist of watering and weed control. The acceptance criteria set out below may be used to assess the planting throughout the establishment period.

The provision of a monthly report on plant condition and establishment works undertaken shall be submitted to the Engineer within five days of the end of each month. A sample report form is shown in the appendices. Information to be provided in this report is set out in clause 14.0 - Establishment.

6.9 Acceptance Criteria

Trees shall:
- be located as specified.
- be upright and firm in the ground.
- be securely staked.
- have the top of the root ball level with the surrounding surface.
- be healthy with no evidence of decline or damage (e.g. dead/dying/diseased foliage/tips/branches, loss of foliage that is uncharacteristic to the species, discoloured foliage, pests and diseases).

6.10 Measurement of Work and Basis of Payment

6.10.1 Planting of Specimen Trees

Planting shall be paid per tree and shall include tree transport, site preparation, setting out, fertiliser, planting and mulching to tree pits only. Excavation and filling of tree pits is paid separately.

6.10.2 Establishment

Establishment shall be paid per tree per month. Establishment shall include all items as set out in clause 14.0 - Establishment. The ‘Monthly Establishment Report’ for the period being claimed must be presented with the claim before payment will be made.
7.0 PLANTING OF SHRUBS, GROUNDCOVER AND WETLAND PLANTS

7.1 Scope of Work

This specification is for site preparation, setting out, planting, fertilising and establishment of plant materials.

7.2 Timing

Planting shall generally take place between 1 April and 30 September (the planting season). Planting may occur outside these times with the approval of the Engineer.

The Contractor shall carry out the works to protect the existing subsoil structures and prevent excessive soil structural damage.

Wetland areas that involve permanently or regularly saturated soils, e.g. inter-tidal zones and stream margins may be planted outside the recognised planting season.

7.3 Setting Out

*Planting positions shall be in accordance with the planting plans and spacing shall be as specified.*

The Engineer may require minor refinement to the design with adjustments to lines, levels and grouping of shrubs, groundcover or wetland plants locally as the planting proceeds. The Contractor shall cooperate with this.

In areas of block planting, plants shall be spaced so that when established they will completely and evenly fill the areas indicated, unless otherwise specified. Plants shall be spaced around the perimeter first to define the extent of the area to be filled by each species. The remaining plants shall then be used to fill the centre of the area in an informal manner avoiding straight lines and regular geometric patterns, unless otherwise specified.

7.4 Containerised Shrubs and Groundcover

*Containerised plants shall be thoroughly moistened at the time of planting. If plants are dry, they shall be submerged in water for five minutes until all air bubbles stop rising. Allow time to drain before planting.*

Balled and container grown plants shall have cloth cordage, containers wire containment and hessian removed immediately prior to planting. Care shall be taken to ensure that the root ball is not disturbed during container removal or planting.
If plants are slightly potbound the roots shall be loosened, trimmed and spread out to ensure healthy growth. Roots shall not be exposed to the sun or wind.

7.5 Planting Hole

The planting hole shall be twice the root ball width and twice the root ball depth. Planting holes, except for wetland plants, shall be loosened for at least 75mm each side of and under the plant prior to planting.

7.6 Fertilisers

The specified fertiliser shall be thoroughly mixed with the soil in the base of the planting hole, prior to planting.

Apply quantities as recommended by the manufacturer. The Engineer may vary the amount depending on conditions and stock. The Contractor shall allow for a minimum average fertiliser application rate of 50 grams of 8-9 month slow release fertiliser or approximately one handful and the application of a balanced NPK mix per shrub or ground cover. Wetland plants shall not be fertilised.

7.7 Planting Shrubs and Groundcover

Plants shall be set upright in the centre of the pit at such a depth that the soil, when firmed down is at the same height as the top of the root ball. Soil shall be heeled in using natural body weight and not compacted by machinery or ‘stamped’ down. Any major roots that accidentally break off or fray shall be cleanly cut off from the plant.

Loose roots shall be spread out in a radial fashion, and the pit progressively backfilled with first class topsoil, carefully placed under and amongst them to fill all voids and consolidated so that no air pockets are present and the plant is firmly held.

Where roots are pot bound and/or girdling they shall be cleanly severed at the edge of the root ball and gently teased out in a radial fashion.

Each plant shall be watered thoroughly after planting, ensuring that the moisture has penetrated to the full depth of the root ball (initial watering is also important to settle the soil around the roots).

Unless otherwise specified all newly planted trees (shrubs and groundcover) shall be mulched in accordance with clause 8.0 - Mulching.
7.8 ‘Wetland’ Plants

Plants identified for ‘Wetland’ areas shall be planted into permanently or temporarily saturated areas. Planting of aquatic and semi aquatic wetland plants (in stream beds and inter-tidal zones) requires roots to be buried to ensure they do not float away. These plants may also require pinning down or a small amount of gravel may be added to weight down soil.

Plant in bands or lines following natural contours or as required by the Engineer.

Extreme care is required to ensure ‘wetland’ plants do not dry out during storage, transportation and planting. If drought conditions occur planting into some areas should be delayed until soil moisture levels are sufficient to sustain the plants. The Contractor shall consult the Engineer over any concerns with soil moisture levels.

7.9 Establishment

Works to achieve establishment of the plants shall be carried out by the Contractor, in accordance with clause 14.0 - Establishment. This will mainly consist of watering but may also include works such as some plant protection and judicious pruning. The acceptance criteria set out below may be used to assess the planting throughout the establishment period.

The provision of a monthly report on plant condition and establishment works undertaken shall be submitted to the Engineer within five days of the end of each month. A sample report form is shown in the appendices. Information to be provided in this report is set out in clause 14.0 - Establishment.

7.10 Acceptance Criteria

Plants shall:

- be located as specified.
- be upright and firm in the ground.
- have the top of the root ball level with the surrounding surface.
- be healthy with no evidence of decline or damage (e.g. dead/dying/diseased foliage/tips/branches, loss of foliage that is uncharacteristic to the species, discoloured foliage, pests and diseases).

7.11 Measurement of Work and Basis of Payment

7.11.1 Shrubs, Groundcover and Wetland Plants

Shrubs, groundcover and wetland plants shall be paid per plant. Payment shall include plant transport, excavation of the planting holes and disposal of spoil, planting preparation, setting out, filling, fertiliser where specified and planting.
7.11.2 Additional Subgrade Modification
Additional subgrade modification shall be per m$^2$ and shall include excavation, disposal of excavated material, supply of second-class soil and its placement.

7.11.3 Establishment
Establishment shall be paid per m$^2$ of plant bed per month. Establishment shall include all items as set out in clause 14.0 - Establishment. The ‘Monthly Establishment Report’ for the period being claimed must be presented with the claim before payment will be made.

8.0 MULCHING

8.1 Scope of Work
This specification is for post planting spraying with pre-emergent herbicides and mulching.

8.2 Preparation
Grass shall be removed by careful hand excavation or shall be standing dead (i.e. not recently sprayed) prior to mulch being applied.

Spraying and the use of herbicides shall comply with the requirements of CSS: Part 2 - Earthworks. Pre-emergent herbicides shall be applied as specified and at the manufacturer’s recommended rate.

Spraying with pre-emergent herbicides shall occur after planting and before mulching. The topsoil surface shall be smooth, uniform and lightly consolidated prior to spraying. If the ground is dry, a thorough watering shall be carried out before spraying.

8.3 Mulch
Mulch shall be as specified.

8.3.1 Decomposed Tree Chip, Cambium Grade Bark, Crushed Shell, Other Medium
The surface of the mulch shall be flush with or no more than 25mm below the surrounding ground surface, kerb, path or other formed surface and shall be even and free of hollows.

Mulch to tree pits in reserves shall be placed over the tree pit radially to 1000mm from the trunk of the tree or to the extremity of the tree’s drip line, whichever is the greater. Mulch to tree pits in streets shall be spread radially to 600mm from the trunk of the tree.
Mulch shall not touch the stems of plants. A small circle shall be cleared (diameter of 50mm minimum) around the stem to avoid stem rot. Mulch shall be pulled back to 100mm off the trunk of any tree to prevent collar rot.

Unless specified otherwise, mulch shall be placed and maintained to a minimum consolidated depth of 100mm for planting beds and tree pits.

Topsoil shall not be mixed into the mulch during placement, planting or weeding.

Bark mulch shall not be placed below the annual flood level within the channel or within regularly inundated tidal margins.

8.3.2 Wool Mulch
Rolls shall be laid across the slope and pegged down with wire hoops. Wire holding hoops shall be at least 200mm long and shall be spaced at a minimum of 1.0m centres. The soil conditions and gradient may require hoops to be placed at closer centres. Overlap between rolls shall be at least 100mm. The top surface or uppermost edge shall lie on top of the bottom edge of the adjacent sheet. Where specified 1 x 1m square mats shall be placed around individual plants. A wire hoop shall peg down these mats in each corner.

8.3.3 Cardboard/Paper Mats
Cardboard circular mulch mats and paper mats shall be placed around each plant after planting where specified. Cardboard or paper mats or circles shall be securely pegged down. Pre-emergent herbicide shall not be placed under these mats. CCC Linwood Nursery will supply the mats, unless otherwise specified.

8.4 Compost, Soil Conditioners and Cultivation Depths

In lawn areas, 100 mm of compost or soil conditioner shall be added and thoroughly mixed to a total depth of 200mm.

In shrub beds, 75mm of soil conditioner or compost shall be added and cultivated to a total depth of 250mm.

Trees shall have equal amounts of compost or soil conditioner and soil.
8.5 Surface Boxes

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3 – Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels

8.6 Acceptance Criteria

8.6.1 Decomposed Tree Chip, Cambium Grade Bark, Crushed Shell, Other Medium

*Mulch shall be free of weeds and a minimum consolidated depth of 100mm or as specified at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate.*

*Mulch shall cover the specified area*

*Mulch shall not spread onto paved surfaces or onto lawn areas. Where a mulched area is adjacent to a hard surface, mulch shall be flush with or no more than 25mm below the surrounding surfaces.*

*Topsoil shall not be mixed into the mulch.*

8.6.2 Wool Mulch and Cardboard or Paper Mats

*Wool mulch mats and paper or cardboard mats shall be securely pegged down.*

8.6.3 Compost, Soil Conditioners and Cultivation Depths

*The mixed material shall have a consistent appearance.*

8.7 Measurement of Work and Basis of Payment

8.7.1 Decomposed Tree Chip, Cambium Grade Bark, Crushed Shell, Other Medium

*Mulch shall be paid by m², to the nearest m². Mulch rates shall include supply and application of pre-emergent herbicide. Mulching of tree pits shall be included in the rate for planting of specimen trees.*

8.7.2 Wool Mulch

*Wool mulch shall be paid by m², to the nearest m². Mulch rate shall include the supply and application of pre-emergent herbicide.*
8.7.3 Cardboard/Paper Mats
Cardboard and paper mats shall be paid per item and shall include transport, installation and fixing.

8.7.4 Compost, Soil Conditioners and Cultivation Depths
Compost and soil conditioners shall be paid by m² to the nearest m² and shall include cultivation.

8.7.5 Surface Boxes
The Contractor shall include the cost of adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing storm water inspection openings, and traffic signal loop toby boxes in the rate for the placement of mulch.

Payment for the adjustment of storm water and sewerage manhole tops shall allow for all work involved.

9.0 STAKING TREES AND SHRUBS

9.1 Scope of Work
This specification is for the staking of specimen trees and the identification and stem protection of trees and shrubs.

9.2 Tree Stakes

Newly planted specimen trees shall be supported by stakes complying with SD 702, unless specified otherwise.

Stakes shall be untreated timber, 50mm x 50mm dimension, uniform in appearance, straight and finished to a uniform height. Stakes shall be driven into the ground to a depth sufficient to support the tree, shall be upright and immovable.

All tree ties shall be either jute (Hessian) or rubber inner bicycle tubes to allow minor movement without chafing of the stems and to allow the development of supportive ‘reaction wood’ and a strong supporting root system. Other tree ties shall be approved by the City Arborist prior to use. Unless otherwise specified, tree ties shall be placed at one third the height of the tree from ground level to a maximum height of 600mm.

9.3 Identification Stakes

Identification stakes shall be installed to plants as specified. These shall be inserted at the time of planting to ensure that roots are not damaged. The identification stake shall be of untreated timber or similar and shall be no longer than 1.0m.
9.4 Stem Protectors

Planting shall be protected with flexible corrugated and perforated PVC pipe where specified. Trees shall have 150mm diameter 300mm long protectors and shrubs shall have 150mm diameter 200mm long protectors. The protectors shall be installed around the base of the plant and secured into the ground.

9.5 Measurement of Work and Basis of Payment

Tree staking, identification stakes and stem protectors shall be per item.

10.0 ROOT BARRIERS

10.1 Scope of Work

This specification is for the supply and installation of tree root barriers.

10.2 Construction

Root barriers shall be supplied and installed in accordance with SD 704.

The location of root barriers shall be as specified. The barrier shall be centred about the stem. Each barrier shall be impermeable to penetration by roots, a minimum of 2000mm length and 300mm depth. The top of the root barrier shall be level with the surrounding surfaces i.e. not protruding above the surface.

All root barriers shall be installed prior to the planting of trees or as specified.

10.3 Measurement of Work and Basis of Payment

Root barriers shall be paid per barrier or per metre, as specified and shall include supply of all materials, installation, backfilling and restoration.
11.0 TREE GUARDS AND GRATES

11.1 Scope of Work

This specification is for the supply and installation of tree guards and tree grates.

11.2 Construction

*Foundations for tree grates shall comply with SD 708, SD 709 or SD 710, as specified. Tree grates shall comply with SD 705 and SD 706, as specified. Tree guards shall comply with SD 707.*

11.3 Measurement of Work and Basis for Payment

Tree grates, grate foundations and tree guards shall be paid per item and shall include supply and installation.

12.0 TURF SUPPLY AND LAYING

12.1 Scope of Work

This Specification is for the supply, laying and establishment of turf.

12.2 Materials

*The turf shall be of good quality, free of weeds and pests and of a minimum thickness of 20mm.*

The turf grass mix shall be as specified. The turf shall be sufficiently fibrous for turves to hold together when handled, but excess fibre or thatch is undesirable.

The Contractor shall inform the Engineer of the location of the supply so that the turves can be inspected prior to lifting.

12.3 Surface Boxes

*Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3– Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels.*
12.4 Traffic Signs

All regulatory traffic signs shall be reinstated prior to the removal of the traffic management. All information signs shall be reinstated as soon as practicable. All traffic signs shall be reinstated in terms of CSS: Part 6 clause 24.0 - Traffic Signs.

12.5 Laying

Turf shall be delivered to the site and installed within 36 hours of lifting. Turf shall be kept damp. Slow release fertiliser shall be applied as specified to the turf prior to watering.

Turf shall be laid on topsoil placed to CSS: Part 2 - Earthworks. Topsoil shall be cultivated to 25mm to form a fine even bed.

The Contractor shall carry out the works to protect the existing subsoil structures and prevent excessive soil structural damage.

Turf shall be handled with care and laid in a stretcher bond pattern. The turf shall be laid from planks working over turves previously laid.

The turves shall be thoroughly watered until the turf mat and top 50mm of soil is wet. Allow a ‘soaking in’ period prior to lightly and evenly rolling so that the turf mat and the soil surface are thoroughly bonded.

Any inequalities in finished levels owing to variation in turf thickness or uneven consolidation of soil shall be adjusted by raking and/or packing fine soil under the turf, not by topdressing the turf surface.

12.6 Establishment

Works to achieve establishment of the turf shall be carried out, by the Contractor, in accordance with clause 14.0 - Establishment. This will mainly consist of watering, mowing and weed control. The acceptance criteria set out below may be used to assess the lawn throughout the establishment period.

The grass shall be maintained over the establishment period at a height of between 25mm and 50mm as measured by the Rising Disc test method ‘New Zealand Sports Turf Institute’.

12.7 Acceptance Criteria

The lawn shall be an even sward of vegetation at a uniform height with a healthy colour throughout. The lawn shall be free from hollows arising from uneven consolidation of the ground and from stones or similar debris.
The specified grasses shall be evenly distributed across the lawn and the entire ground surface covered. The grass sward shall not contain any non-specified grasses or weeds. The lawn height shall be between 25mm and 50mm.

12.8 Measurement of Work and Basis of Payment

12.8.1 Turf
Turf shall be paid by m², to the nearest m² and shall include preparation of the bed, fertiliser, rolling and establishment.

12.8.2 Surface Boxes
The Contractor shall include the cost of adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing storm water inspection openings, and traffic signal loop toby boxes in the rate for the placement of turf.

Payment for the adjustment of storm water and sewerage manhole tops shall allow for all work involved.

12.8.3 Traffic signs
Payment for the relocation of traffic signs shall be by lump sum or per sign relocated as specified.

12.8.4 Establishment
Establishment shall be included in the rate for turf and shall include the disposal of clippings from mowing.

13.0 SOWING OF LAWN AREAS

13.1 Scope of Work
This Specification is for the formation, sowing and establishment of lawn areas in roadways (berms), parks and reserves (amenity areas and playing fields) and swales.

13.2 Seed Mixture
The seed mix shall be as specified. Mixes shall be in accordance with CSS: Part 1 - General.

The Contractor shall provide the Engineer with a certificate from the seed merchant supplying the seed verifying that the mixture is as specified and that the seed is no more than one year old.

13.3 Sowing
The method of sowing shall achieve a uniform distribution of seed at the following rates, unless otherwise specified: 300kg per hectare (30 grams per square metre) for berm and high profile amenity areas; 250kg per hectare (25 grams per square metre) for playing field areas, swales and other amenity areas; 50kg per hectare for pasture.

The seed shall be applied and cultivated to 20mm depth so that the minimum of seed is exposed. The seeded ground shall be levelled and lightly consolidated to ensure good soil/seed contact.

Slow release fertiliser shall be applied as specified before or during sowing at the manufacturer’s specified application rates. Fertiliser shall not be applied in waterway areas.

A low-pressure system shall be used to avoid surface rilling or erosion.

13.4 **Hydroseeding**

The hydroseeding mulch shall be a mixture of the specified seed, wood-fibre based mulch, fertiliser and a binding agent. The percentage of wood fibre in the hydroseeding mulch shall be no less than 75%.

The mulch shall be applied to a minimum depth of 5mm. Application rates for berms and high profile amenity areas shall be no less than 200kg/1000m².

Products such as “Hytrad” or an equivalent are acceptable hydroseeding mulches.

Mulch shall be applied using a suitable pumping system with mixing abilities, to prevent settling between applications.

All existing site features, such as paths and fences, shall be protected during mulch application. Any overspray shall be removed promptly.

A low-pressure system shall be used to avoid surface rilling or erosion.

13.5 **Surface Boxes**

Surface boxes shall be accessible, adjusted and repainted in accordance with the requirements of CSS: Part 1 - General. Water supply surface boxes shall be adjusted and repainted in accordance with the requirements of CSS: Part 4 clause 12.3– Surface Boxes Installed or Adjusted Separately from Watermain Works. Manholes shall be adjusted in accordance with the requirements of CSS: Part 3 clause 16.0 – Adjusting Manholes to Altered Surface Levels

13.6 **Traffic Signs**
All regulatory traffic signs shall be reinstated prior to the removal of the traffic management. All information signs shall be reinstated as soon as practicable. All traffic signs shall be reinstated in terms of CSS: Part 6 clause 24.0 - Traffic Signs.

13.7 Establishment

Works to achieve establishment of the lawn shall be carried out, by the Contractor, in accordance with clause 14.0 - Establishment. This will mainly consist of barricading, watering, fertilising, mowing and weed control. The acceptance criteria set out below shall be used to assess the lawn throughout the establishment period.

The grass shall be first cut at 50mm and then maintained over the establishment period at a height of between 25mm and 50mm, as measured by the Rising Disc test method ‘New Zealand Sports Turf Institute’. Swale areas shall have their first cut at 50mm grass height and shall be maintained over the establishment period at a height of between 50mm and 150mm.

13.8 Acceptance Criteria

The lawn shall be an even sward of vegetation at a uniform height with a healthy colour throughout. The ground surface shall be free from hollows arising from uneven consolidation of the ground and from stones or similar debris.

Within two months of sowing, the specified grasses shall be evenly distributed across the lawn with at least 90% of the ground surface covered and with no bare area greater than 30mm in diameter. The grass sward shall have less than 10% of its area in non-specified grasses and weeds, unless otherwise specified.

The lawn height shall be between 25mm and 50mm except swales, which shall be between 50mm and 150mm.

13.9 Measurement of Work and Basis of Payment

13.9.1 Berms
Berms shall be paid by m², to the nearest m², and shall include excavation and disposal of spoil, ripping, cultivation and scarification, topsoil supply and finishing, sowing or hydroseeding and establishment.

Separate rates will be provided for sawcutting and for the installation of battens.
13.9.2 **Repair of Existing Lawn**
Repair of existing lawn shall be measured by the m$^2$, to the nearest m$^2$, and shall include preparation of existing landscape or grassed area, sowing and establishment.

13.9.3 **Playing Fields and Amenity Areas**
Playing fields and amenity areas shall be measured by the m$^2$, to the nearest m$^2$, and shall include preparation, sowing and establishment.

13.9.4 **Swales**
Swales shall be measured by the m$^2$, to the nearest m$^2$, and shall include preparation, sowing and establishment.

13.9.5 **Surface Boxes**
The Contractor shall include the cost of adjustment of all water supply service boxes, including repainting, vents, sewer gully traps, existing stormwater inspection openings, and traffic signal loop toby boxes in the rate for the construction of lawn.

Payment for the adjustment of stormwater and sewerage manhole tops shall allow for all work involved.

13.9.6 **Traffic signs**
Payment for the relocation of traffic signs shall be by lump sum or per sign relocated as specified.

13.9.7 **Establishment**
Establishment shall be included in the rate for the item and shall include the disposal of clippings from mowing where specified.

### 14.0 ESTABLISHMENT

#### 14.1 Scope of Work

This Specification covers the work typically undertaken to provide optimum conditions to establish the constructed landscape, over the Defects Liability period.

This should include barricading, watering, weed control, cultivation, control of pests and diseases, removal of litter, checking of stakes and ties, trimming, pruning or mowing and other accepted horticultural operations necessary to ensure normal and healthy landscape establishment and growth, and the monthly reporting of the works carried out under this clause.

The two most important factors are adequate moisture and eliminating competition from other vegetation. Throughout the establishment period,
the Contractor shall visit the site as and when necessary, to ensure that plant establishment is not limited by drought stress or competition from other plants. Details of the proposed methods and frequency of such activities, and the reporting of these, shall typically be set out in the Contractor’s Contract Quality Plan.

14.2 Watering

_The Contractor shall provide sufficient water to all lawn areas, trees and planting to maintain plants in a healthy condition. For trees, soil moisture shall contain an average volumetric water content of between 20 and 30%. This value shall be determined through taking four readings corresponding approximately to the four points of the compass. The readings shall be at 500mm below the topsoil surface and 300mm from the trunk for trees up to pb95 grade and 500mm from the trunk for pb150 grade trees. Moisture contents for trees above pb150 grade will be specified._

For trees, this moisture content relates approximately to 40 litres of water per application in order to saturate the root ball. For trees larger than pb150 grade, each application should be approximately 80 litres of water. As a guide, shrubs and groundcover should receive 5 litres of water each per application in order to saturate the root ball. Applications should occur at least once a week during summer months (October – March inclusive) and/or as directed by Council.

Water shall be applied evenly and radially around the root ball to a distance of 600mm from the base of the trunk or to the extremity of the tree’s drip line, whichever is the greater. Water shall be applied at low pressure from a height of less than 500mm. Care shall be taken to avoid the displacement of soil or mulch whilst undertaking watering.

14.3 Weed Control

14.3.1 Trees

_At no time shall any individual weed be larger than 100mm x 100mm x 100mm high. Weeds that are 50mm x 50mm x 50mm in size shall not exceed more than five per square metre. Weeds shall be controlled without the use of residual herbicides._

The Engineer may approve the use of herbicides. Herbicide use shall comply with CSS: Part 2 - Earthworks.

_At establishment all tree mulch areas shall be free of weeds._

14.3.2 Mulched Plant Beds

_Weed control shall be frequent enough to prevent weed species flowering and seeding. At no time shall any individual weed be larger than 100mm x 100mm x 100mm high. Weeds that are 50mm x 50mm x 50mm in size shall not exceed more than five per_
square metre. Weeds shall be controlled without the use of residual herbicides.

The Engineer may approve the use of herbicides. Herbicide use shall comply with CSS: Part 2 clause 6.0 – Pesticide, Herbicide and Fertiliser Application.

At establishment all mulched plant beds shall be free of weeds.

14.3.3 Unmulched and Revegetation Zones
Weeds shall not encroach within 0.5m of the centre of any plant. Weeds shall be controlled manually within this area unless otherwise approved by the Engineer.

At no time shall any individual weed be larger than 400mm x 400mm x 400mm high. Weeds outside this area shall be maintained between 0.25m and 0.4m in height. When hoeing/pulling, care shall be taken to avoid damage to plants and their roots.

The Engineer may approve the use of herbicides. Herbicide use shall comply with CSS: Part 2 clause 6.0 – Pesticide, Herbicide and Fertiliser Application.

14.3.4 ‘Wetlands’
Weeds shall not encroach within 500mm of the centre of any plant. Weed control shall be frequent enough to prevent weed species flowering and seeding. At no time shall any individual weed be larger than 400mm x 400mm x 400mm high. Weeds outside this area shall be maintained between 0.25m and 0.4m in height.

Hand weeding and releasing shall be the only control method employed within and up to one metre from the waterway. In all other areas, weeds shall be controlled manually unless otherwise approved by the Engineer. When hoeing/pulling, care shall be taken to avoid damage to plants and their roots.

The removal of aquatic and semi-aquatic vegetation shall retain any natural stream meander within the channel.

Aquatic vegetation removed from the channel shall be left on the bank margin within one metre of the channel for a period of 24 hours. This allows stream fauna to migrate back into the channel prior to removal of the debris off site. Volumes less that 0.5m³ may be removed from site immediately.
14.4 Pests and Diseases

The Contractor shall promptly report all animal, insect or fungal infestations to the Engineer.

14.5 Rubbish and Litter Collection and Removal

The Contractor shall remove all litter from the landscape area and berms or swales.

Litter is defined as any refuse, garbage, rubbish, dead animal remains, plant debris including fallen leaves, glass (broken or whole), metal, organic or inorganic waste matter or any other material, which is detrimental to the appearance of the site including fly tipping. Fly tipping includes items such as rubbish bags, builders' rubble, motor vehicle bodies or larger items requiring removal by machine.

The Contractor shall notify the Engineer of suspected fly tipping.

14.6 Pruning

All weak, dead, diseased or damaged growth, including spent flower heads, shall be removed. Sight lines at intersections and driveways shall be maintained and signs shall not be obscured.

Pruning shall not be carried out during leaf burst or leaf fall.

14.6.1 Pruning of Shrubs

Pruning shall be carried out on shrubs and groundcover by an appropriately qualified horticulturalist to maintain a high standard of presentation, display and plant vigour and to maintain the desired shape and size.

The following pruning techniques shall be employed where appropriate:

- Tips shall be pinched or purged, as appropriate for species, to give desired shape and size.
- Form pruning of young plants to ensure compact form and shape.
- Undercutting of groundcovers at border edges.
- Plants shall be pruned so that they do not smother neighbouring plants.
- Plants shall be pruned off footpaths and accessways and hard surfaces.

14.6.2 Pruning of Trees

All tree pruning shall be undertaken by a qualified and experienced arborist to accepted modern international arboricultural standards. The name and qualifications of the
arborist shall be submitted to the Council through the Contract Quality Plan.

Pruning shall consist only of removal of broken or dead/dying or diseased branches.

14.7 Plant Vandalism, Losses and Replacement

14.7.1 Vandalism and Theft of Plants
Any plants vandalised or stolen shall be reported promptly to the Engineer and recorded on the ‘Monthly Establishment Report’. The likely cause of damage shall also be reported. The plants shall be removed and replaced where ordered.

Plant loss due to vandalism about which the Engineer is not notified shall be assumed a result of planting operations and replacement shall be at the Contractor’s cost.

The Engineer will determine the value of plants or other landscape works lost due to theft, wilful damage or vandalism.

14.7.2 Losses
The Engineer may determine losses of a single species greater than 25% are due to extreme weather and are therefore not the Contractor’s responsibility.

14.7.3 Replacements
Replacements to make good defects shall be planted either during the planting season immediately following their loss or on discovery and then maintained until the next planting season. Replacements shall be the same as those specified, unless otherwise agreed between the Engineer and the Contractor.

The Engineer may order replacement of plants that die through no fault of the Contractor.

Any defective stakes, ties, etc shall be replaced as soon as possible.

14.8 Lawn Vandalism and Damage

The Contractor shall be responsible for any damage that occurs prior to the first cut at 50mm or that is traceable to this period. Subsequent lawn damage from public vandalism, including vehicle, bicycle and foot damage, shall be promptly reported to the Engineer. The likely cause of damage shall also be reported.

The Contractor shall notify the Engineer of grassed areas damaged by others during the course of their legitimate work, as opposed to
vandalism. The Contractor shall notify the Engineer of areas that in his/her opinion have become worn due to wear and tear.

14.9 Monthly Establishment Report

An accurate and up to date monthly report, on plant condition and establishment works undertaken, shall be submitted to the Engineer within five days of the end of each month.

Information to be provided in this report shall include the date that works were carried out and any types of work, as noted in the above clauses, to aid establishment of landscape areas and berms. A sample report form is shown in the appendices ‘Monthly Establishment Report’.

Unforeseen damage, for example vandalism, plant losses, shall be reported to the Engineer at the time of inspection.

Any unreported damage or plant losses will be deemed the responsibility of the Contractor.

14.10 Measurement of Work and Basis of Payment

Establishment shall include watering, weed control, cultivation, control of pests and diseases, checking of stakes and ties, trimming, pruning or mowing and removal of clippings where required, removal of litter and other accepted horticultural operations necessary to ensure normal and healthy landscape establishment and growth, and the monthly reporting of the works carried out under this clause.

The ‘Monthly Establishment Report’ for the period being claimed must be presented with the claim before payment will be made.

14.10.1 Establishment of Specimen Trees
Establishment shall be paid per tree per month.

14.10.2 Establishment of Shrubs, Groundcover and Wetland Plants
Establishment shall be paid per m² of plant bed per month.

14.10.3 Replacements
The supply and planting of replacement plants shall be at the Contractor’s cost, unless otherwise agreed by the Engineer.

14.10.4 Lawn Vandalism and Damage
The repair of lawn damage and vandalism prior to the first cut at 50mm or that is traceable to this period shall be at the Contractor’s cost.
LANDSCAPE CONSTRUCTION MONTHLY ESTABLISHMENT REPORT

Contract No: __________________________________________

Job Name: ____________________________________________

Contractor: ___________________________________________

Defects Liability Period: From: __________ To: __________

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I confirm that the above inspections and work were carried out during this period.

Signed: ___________________________ Date: __________

Company: ___________________________
## COMPLIANCE REQUIREMENTS CHECKSHEET - LANDSCAPE

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<td>Handling</td>
<td>Inspect</td>
<td>Lifted by container, true to specification</td>
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<td>Pt 7</td>
<td>6.7</td>
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<td>Inspect</td>
<td>Soil at top of rootball, roots spread and voids filled, tree firm, watered, staked and mulched</td>
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<tr>
<td>Pt 7</td>
<td>6.9</td>
<td>Tree acceptance criteria</td>
<td>Inspect</td>
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### 4 PLANTING SHRUBS, GROUNDCOVER, WETLAND PLANTS

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<td>Soil at top rootball, roots spread and voids filled, plant firm, watered, upright</td>
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<td>Planting wetland plants</td>
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### 5 MULCHING

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<td>Grass removal</td>
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<td>Remove by hand or standing dead</td>
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<td>TEST FREQ.</td>
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<td>TEST BY</td>
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<td>8.2</td>
<td>Pt 7 8.2</td>
<td>Herbicide application</td>
<td>CSS Part 2</td>
<td>Complies with specification, after planting before mulch</td>
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<tr>
<td>8.3</td>
<td>Pt 7 8.3</td>
<td>Mulch material</td>
<td>Specify</td>
<td>Complies with specification</td>
<td></td>
<td></td>
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<td>8.3.1</td>
<td>Pt 7 8.3.1</td>
<td>Mulch placement</td>
<td>Inspect</td>
<td>+0mm, -25mm surrounding surface, 100mm depth, No topsoil mixed in, not placed below flood or tide level</td>
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<tr>
<td>8.3.1</td>
<td>Pt 7 8.3.1</td>
<td>Mulch placement to trees in streets</td>
<td>Measure</td>
<td>100mm clear of trunk, to 600mm frm trunk</td>
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<td>8.3.1</td>
<td>Pt 7 8.3.1</td>
<td>Mulch placement to trees in reserves</td>
<td>Measure</td>
<td>100mm clear of trunk, to greater of 1000mm from trunk or drip line</td>
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<td>8.3.1</td>
<td>Pt 7 8.3.1</td>
<td>Mulch placement to plants</td>
<td>Measure</td>
<td>50mm clear of stem</td>
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<td>8.3.2</td>
<td>Pt 7 8.3.2</td>
<td>Wool mulch</td>
<td>Inspect</td>
<td>200mm hoops at 1m centres, 100mm overlap, top edge on top</td>
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<tr>
<td>8.3.3</td>
<td>Pt 7 8.3.3</td>
<td>Cardboard/paper</td>
<td>Inspect</td>
<td>Pegged down, no herbicide, where specified</td>
<td></td>
<td></td>
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<tr>
<td>8.4</td>
<td>Pt 7 8.4</td>
<td>Compost and soil conditioner material</td>
<td>Inspect</td>
<td>Complies with specification</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8.4</td>
<td>Pt 7 8.4</td>
<td>Placement - lawn</td>
<td>Measure</td>
<td>Base cultivated to 200mm, 100mm depth added and thoroughly mixed</td>
<td></td>
<td></td>
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<tr>
<td>8.4</td>
<td>Pt 7 8.4</td>
<td>Placement – plant beds</td>
<td>Measure</td>
<td>Base cultivated to 250mm, 75mm depth added and thoroughly mixed</td>
<td></td>
<td></td>
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<tr>
<td>8.4</td>
<td>Pt 7 8.4</td>
<td>Placement - trees</td>
<td>Measure</td>
<td>Equal amounts of compost or soil conditioner and soil</td>
<td></td>
<td></td>
<td></td>
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<td>8.5</td>
<td>Pt 7 8.5</td>
<td>Surface boxes adjustment</td>
<td>CSS Part 1</td>
<td>Adjusted as specified.</td>
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<td></td>
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<tr>
<td>8.6.1</td>
<td>Pt 7 8.6.1</td>
<td>Mulch acceptance criteria</td>
<td>Inspect</td>
<td>100mm depth, confined to specified area, no topsoil mixed</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8.6.2</td>
<td>Pt 7 8.6.2</td>
<td>Mulch acceptance criteria</td>
<td>Inspect</td>
<td>Securely pegged down</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### 6 STAKING

- **Pt 7 9.2**  
  **Task:** Tree stakes  
  **Test:** Specify  
  **Compliance Requirements:** Complies with SD

- **Pt 7 9.3**  
  **Task:** Identification stakes  
  **Test:** Inspect  
  **Compliance Requirements:** Installed at time of planting, untreated timber, under 1m

- **Pt 7 9.4**  
  **Task:** Stem protector materials  
  **Test:** Inspect  
  **Compliance Requirements:** 150mm diameter, flexible corrugated perforated PVC pipe

- **Pt 7 9.4**  
  **Task:** Stem protectors - trees  
  **Test:** Inspect  
  **Compliance Requirements:** 300mm long, secured to ground

- **Pt 7 9.4**  
  **Task:** Stem protectors - shrubs  
  **Test:** Inspect  
  **Compliance Requirements:** 200mm long, secured to ground

### 7 ROOT BARRIERS

- **Pt 7 10.2**  
  **Task:** Materials  
  **Test:** SD 704  
  **Compliance Requirements:** Complies with specification

- **Pt 7 10.2**  
  **Task:** Installation  
  **Test:** SD 704  
  **Compliance Requirements:** Located as specified, before tree planting

### 8 TREE GUARDS AND GRATES

- **Pt 7 11.2**  
  **Task:** Construction  
  **Test:** Specify  
  **Compliance Requirements:** Complies with SD

### 9 TURF SUPPLY AND LAYING

- **Pt 7 12.2**  
  **Task:** Turf materials  
  **Test:** Inspect  
  **Compliance Requirements:** Good quality, weed free, +20mm thick, grass as specified, hold together

- **Pt 7 12.3**  
  **Task:** Surface boxes adjustment  
  **Test:** CSS Part 1  
  **Compliance Requirements:** Adjusted as specified.

- **Pt 7 12.4**  
  **Task:** Laying  
  **Test:** Inspect  
  **Compliance Requirements:** Laid within 36 hours of lifting, kept damp, fertilised prior to watering until top
<table>
<thead>
<tr>
<th>ITEM</th>
<th>CSS REF</th>
<th>TASK</th>
<th>TEST STD/ DESCRIPT</th>
<th>COMPLIANCE REQUIREMENTS</th>
<th>TEST FREQ.</th>
<th>PASS YES/NO</th>
<th>TEST BY</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50mm wet</td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 12.4</td>
<td>Laying</td>
<td>Inspect</td>
<td>Stretcher bond pattern, on 25mm cultivated topsoil, with levelling soil underneath</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 12.6</td>
<td>Turf acceptance criteria</td>
<td>Inspect</td>
<td>Even healthy sward, uniform 25mm – 50mm height, no hollows or stones, ground covered, no weeds</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>SOWING LAWN</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 13.2</td>
<td>Seed mixture</td>
<td>Inspect</td>
<td>Complies with specification. Certificate received, seed under 12 mths old</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 13.3</td>
<td>Sowing weights</td>
<td>Measure</td>
<td>Uniform 30g/m² berm, high profile, 20g/m² other lawn, swale, 50kg/ha pasture</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 13.3</td>
<td>Sowing method</td>
<td>Inspect</td>
<td>Cultivated to 20mm, lightly consolidated, fertilised, erosion avoided</td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 13.4</td>
<td>Hydroseeding materials</td>
<td>Measure</td>
<td>Complies with specification, +75% wood fibre</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 13.4</td>
<td>Hydroseeding application</td>
<td>Measure</td>
<td>+5mm depth, 200kg/1000m² berms, overspray removed promptly</td>
<td></td>
<td></td>
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<td>Pt 7 13.5</td>
<td>Surface boxes adjustment</td>
<td>CSS Part 1</td>
<td>Adjusted as specified.</td>
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<tr>
<td></td>
<td>Pt 7 13.7</td>
<td>Sown acceptance criteria - lawn</td>
<td>Inspect</td>
<td>Even healthy sward, uniform 25mm – 50mm height, no hollows or stones, 90% ground covered, &lt;10% weeds, bare areas &lt;30mm dia</td>
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<tr>
<td></td>
<td>Pt 7 13.7</td>
<td>Sown acceptance criteria - swales</td>
<td>Inspect</td>
<td>Even healthy sward, uniform 50mm – 150mm height, no hollows or stones, 90% ground covered, &lt;10% weeds, bare areas &lt;30mm dia</td>
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<tr>
<td>11</td>
<td>ESTABLISHMENT</td>
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<td></td>
<td>Pt 7 11.1</td>
<td>Watering</td>
<td>Inspect</td>
<td>Plants maintained in healthy condition.</td>
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<td>ITEM</td>
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<td>COMPLIANCE REQUIREMENTS</td>
<td>TEST FREQ.</td>
<td>PASS YES/NO</td>
<td>TEST BY</td>
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<tr>
<td>14.2</td>
<td>Pt 7 14.3.1</td>
<td>Weed control - trees</td>
<td>Inspect</td>
<td>Tree soil have 20-30% avg volumetric water content</td>
<td></td>
<td></td>
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<td></td>
<td>Pt 7 14.3.1</td>
<td>Weed control - trees</td>
<td>Inspect</td>
<td>Control individual weeds under 100mm height or spread, &lt;5 weeds/m² over 50mm height or spread. No residual herbicide use</td>
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<td></td>
<td>Pt 7 14.3.2</td>
<td>Weed control – mulched plant beds</td>
<td>Inspect</td>
<td>No flowering weeds. Control individual weeds under 100mm height or spread, &lt;5 weeds/m² over 50mm height or spread. No residual herbicide use</td>
<td></td>
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<td></td>
<td>Pt 7 14.3.3</td>
<td>Weed control – unmulched planting</td>
<td>Inspect</td>
<td>No weeds within 0.5m of plant. Handweed in this area. All weeds under 400mm height or spread. Weeds outside 0.5m circle kept between 250 and 400mm height</td>
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<td></td>
<td>Pt 7 14.3.4</td>
<td>Weed control – wetlands</td>
<td>Inspect</td>
<td>No weeds within 0.5m of plant. No flowering weeds. All weeds under 400mm height or spread. Handweeded within 1m of waterway. Weeds outside this area kept between 250 and 400mm height. Natural meanders kept in channel. Vegetation left on river bank 24 hours</td>
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<td></td>
<td>Pt 7 14.4</td>
<td>Pests and diseases</td>
<td>Inspect</td>
<td>Infestations reported promptly</td>
<td></td>
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<tr>
<td></td>
<td>Pt 7 14.5</td>
<td>Rubbish and litter</td>
<td>Inspect</td>
<td>Landscape areas, berms and swales free of rubbish and litter</td>
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<td></td>
<td>Pt 7 14.6</td>
<td>Pruning</td>
<td>Inspect</td>
<td>Plants green, healthy, vigorous, not damaged, well shaped. Sight lines, signs clear</td>
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<td></td>
<td>Pt 7 14.7.1</td>
<td>Vandalism</td>
<td>Inspect</td>
<td>Reported promptly and recorded</td>
<td></td>
<td></td>
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<td>Pt 7 14.7.3</td>
<td>Replacements</td>
<td>Inspect</td>
<td>Specified plants</td>
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<td>Pt 7</td>
<td>14.8</td>
<td>Lawn vandalism</td>
<td>Inspect</td>
<td>Reported promptly</td>
<td></td>
<td></td>
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<tr>
<td>Pt 7</td>
<td>14.9</td>
<td>Establishment report</td>
<td>Inspect</td>
<td>Submitted within 5 days of end of month</td>
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</table>
VERTICAL TREE STAKING

STREET TREES

Tree pit can be square or circular

2.0m minimum mulch circle

50x50mm untreated timber stake. Length varies with tree size, stake to be immovable.

40mm cycle inner tube or hessian strip. To be tied in a figure eight then wrapped around itself to bind securely. Position to be one third of the height of the tree or at a maximum of 600mm high.

Mulch to be 100mm clear of stem

100mm Consolidated depth of Mulch

Tree pit width to be 3 times the size of the root ball. Tree pit depth to be one and a half times the size of the root ball.

Minimum dimensions 1500mm wide x 1000mm deep.

First class topsoil lightly compacted by body weight

Loosen to 300mm

Minimum 1500mm

maximum 6000mm

100mm

100mm

50x50mm untreated timber stake.
VERTICAL TREE STAKING
RESERVE TREES

Tree pit can be square or circular

2.0m minimum mulch circle

50x50mm untreated timber stake. Length varies with tree size. Stake to be immovable.

40mm cycle inner tube or hessian strip. To be tied in a figure eight then wrapped around itself to bind securely. Position to be one third of the height of the tree or at a maximum of 600mm high.

Mulch to be 100mm clear of stem

100mm Consolidated depth of Mulch

Form edge as specified

Stakes to contained within the tree surround and uniform in appearance

Greater of 1000mm or extremity of the dripline

Tree pit width to be three times the size of the root ball.

Tree pit depth to be one and a half times the size of the root ball. Minimum dimensions 2000mm wide x 1000mm deep.

First class topsoil lightly compacted by body weight

Loosen to 300mm

Loosen to 300mm

Minimum 2000mm

Maximum 600mm

Minimum 1000mm

2.0m minimum mulch circle
H3 treated timber rails to be 75x25mm

SQUARE TREE STAKING

150mm of stake into undisturbed soil

Flexible tie to SD702

Mulch to be 100mm clear of stem

Stakes to be 75x75mm untreated timber

100mm Consolidated depth

Tree pit to SD702

Mulched tree ring to SD702

150mm of stake into undisturbed soil
TREE ROOT BARRIER

SD704

Approved root barrier material

Tree Pit to SD702

Tree root location as specified

Mulch to SD702

SD 25 M uh bolt 900mm

600mm or 600mm

300mm

where root barrier is not self supporting

Berms

2.0 Minum

Kerb or Hard Surface

Hard Surface

Sheet
Tree grate to be cast in four sections around the tree using galv. M16 bolts as detailed.

Hole drilled to 50mm depth and tapped to take M12 bolt if required.

M12 G.M.S. Bolt
M16 G.M.S. bolts if required
Main Spokes of equal thickness from outside edge through to centre.
Tree grate to be cast in four sections and bolt fixed together around tree using galv. M16 bolts as detailed.
Sections between main spokes on radials & tapering thickness towards centre.

1. CROSS SECTION

2. TREE GRATE FIXING

3. GUARD FIXING

4. TREE GUARD FIXING
Unit constructed in four (4) sections

Notes:
1. Units to be from mild plate steel & hot dip galvanised after fabrication
2. Units to be painted to Resene specification 23e 2.4 ULT Colour 'Shark' 10/450 unless otherwise specified
3. All bolts to be hot dip galvanised and to sizes as specified
4. All welds to be fillet/sealed as specified to dimensions as shown
5. Cut bolt ends & burr to prevent being undone.

See sheets 2&3 for base plate dimensions
50mm M12 Bolt & nut with nut 5mm fillet welded all round to base as shown. Bolt to act as set screw for levelling.

M12 bolt into tree grate through slots cut in all flat steel ends at the base of the unit. Slots ensure that the tree guard can be attached vertically when the tree grate has up to a maximum gradient of 4.5° (1:8 or 12%).

BASE DETAIL

TREE GUARD BASE FOR SMALL TREE GRATE

SD707

Christchurch City Council
50mm M12 Bolt & nut with nut 5mm fillet welded all round to base as shown. Bolt to act as set screw for levelling.

M16 bolt into tree grate through slots cut in all flat steel ends at the base of the unit.

Slots ensure that the tree guard can be attached vertically when the tree grate has up to a maximum gradient of 4.5° (1:8 or 12%).

Maximum gradient of 4.5° (1:8 or 12%)
50x25mm H4 treated timber battens fixed to concrete with two (2) M10x90mm dyna bolts per batten.

Paver to be mortared to concrete foundation.

Total depth of hole varies.
PAVER LAYOUT

PLAN

CROSS SECTION

1

17.5MPa concrete guard

Paver to be mortared to concrete foundation

Total depth of hole varies

KERBSIDE GRATE FOUNDATION

Christchurch City Council

ISSUE DATE FEB 2002

SD709

SHEET 1
PAVER LAYOUT

PLAN

CROSS SECTION

Tree root barrier & stakes to SD704 around circumference of grate foundation

Paver to be mortared to concrete foundation

17.5MPa concrete guard

Total depth of hole varies

MINOR GRATE FOUNDATION

SD710
40x10mm flat steel

Outline off 52x32mm timber arm rest

Capped end to support

NB25 Medium grade Bpipe arm rest

NB25 Medium grade Bpipe supports

<10mm drilled hole in upright to permit air movement from arm rest when galvanised.

Open end to pipe support

40mm N.B. medium grade Bpipe uprights, flattened at top to fit supports

* Varies depending on surface type

Refer to SD712 for foundation details

END ELEVATION

ARM REST PLAN

SD711
Steel pipe to be of type and sizes as follows:
- Supports: NB25 Medium grade Bpipe
- Uprights: NB40 Medium grade Bpipe
- Arm rests: NB25 Medium grade Bpipe

2. All steel joints to have 6mm fillet welds all round.

3. Steel units to be hot dip galvanised prior to installation.

4. Steel units to be powder coated to manufacturer's specifications when & as specified.

5. All bolts to be M5 galvanised round heads with capping nuts.

6. All timber to be from suitable hardwood and oil stained.

7. Timber rails to be finished to 32x42mm and to have 2mm rounding to all edges.

8. Arm rests are optional, where specified.

9. Timber arm rests to be finished to 52x32mm and to have 2mm rounding to all edges.

Notes:

*Varies depending on surface type

Refer to SD712 for foundation details

HALF FRONT ELEVATION
3 5 0
* 
Varies depending on surface type

600
400
100

Seat Outline

Hord Surface
eg. Asphalt, Concrete, Pavers etc...

NOTE: Legs may be sleeved
with 100mm dia PVC pipe
and filled with non-shrink
grout

17.5MPa concrete foundation

900 disabled seat
access where required

2000 Minimum

10 0

900 Minimum

2000 Minimum

300

100

600

300

600

10 0

533x726

ISSUE DATE
FEB 2002

SD712

PARK BENCH
INSTALLATION

Christchurch City Council

FOUNDATION PLAN

FOUNDATION DETAIL
Screw M16 70mm long

U-bolt to be out of Ø16mm MS rod and not dip galvanised

Litter bin and top (supplied by C.C.C.)

M16 Nyloc nuts and taper washers

Drainage gap to be on down side of pavement

U-bolt set into concrete

17.5MPa Concrete foundation

Ground Level
100

500

800 to square end

1400

150mm SED H4 treated standard post

150mm SED H4 treated standard post

25

100

100

25

100

700

100

100

1200

700

500

100

25

100

3000 typical

3000 typical

17.5MPa Concrete footing to end posts

H4 treated 200mm SED strainer post

Flanged or two 121 taped cable clamps

Galvanised square nut fully threaded shaft and 100mm extra

M16 galvanised eye bolt with fully threaded shaft and 100mm extra

Ground Level

Cable Fence

POST AND CABLE FENCE

Christchurch City Council
150mm galvanised flathead nail through the post and one link of the chain

Posts are 150x100mm H4 treated timber & 2500mm crs (+/- 300mm to fit the fence length)

8mm galvanised chain

100mm Maximum

17.5MPa Concrete footing to end posts

Compacted TNZ

M/4 : AP40

As specified

1000 or 1100 As Specified

Ground Level

5000

100

100

100

100

500

100

100

100

100

2500

50

50

25

25

10mm Rebate
**PLAN**

1. **Existing Grass Berm**
2. **Existing Kerb and Channel**

**Cutdown offset 1.0m either side of entrance**

**Transition area to join existing path to entrance, within 10m of Park Entrance.**

This area may have to be landscaped if people exit directly over kerb.

- Cutdown NOT to be offset if:
  - (a) Low traffic volumes (<900 vehicles/day)
  - (b) High cycle numbers (≥20 cyclists/any one hour)
  - (c) Width 'W' < 2.0m

**Preferred distance** (either side) to solid fence

- 2.5m

**Entrance posts to be 1.1m**

**Fence type as specified**

- 1.2m or 1.4m as specified (min)
  - R1.0m (min)

**PLAN**

**PARK ENTRANCE**

SD716

**ISSUE DATE**

FEB 2002

**SHEET 1**
Notes:
1. All timber to be H4 treated (non-corrosive type)
2. All timber to be gauged with the top and seat members to have 5mm chamfer to top edges
3. Top and seating timber to be from 100x75mm with 6mm gaps between
4. Supports to be from 125x75mm timber
5. Legs to be from 100x100mm timber
6. Bolts to be G.M.S.M16 with 50x50x3mm G.M.S. washer under both heads and nuts
7. Concrete slab to be 125mm thick 17.5MPa with R10 rods at 300mm c/c approx both ways
Concrete top to have a U3 trowelled finish.

Concrete base to be squared off if located next to a wall.

Painting Specification:
- E-Mac Drinking fountain colour to be Resene Karaka 1G015 unless otherwise specified.

Visible steel form work surfaces to be painted to the following specification:
- Surface preparation - Non Ferrous Metals (Resene data sheet D89)
  - 1st coat - Armourcote 510 (Resene data sheet RAL0)
  - 2nd coat - Vinyl Etch (Resene data sheet RA31)
  - 3rd coat - *pigmented Uracryl 403 (Resene data sheet RA56)
  - 4th coat - Clear Uracryl 403 (Resene data sheet RA56)

*Colour to be Resene Karaka 1G015 unless otherwise specified.

All painting to be carried out to ensure no paint splashes & over runs occur on other surfaces.
SPECIFICATION:

1. GALVANISING:
   a. All steel fixings to be hot dip galvanised.
   b. Supports shall be hot dip galvanised after fabrication, with all blowholes located so as not to allow water (rain/washing down) to enter the frame. Blowholes shall be located in non-visible locations wherever possible.
   c. Hot dip galvanising shall be in accordance with NZS 4680.
   d. All hot dip galvanising defects shall be repaired by hot zinc metalspray.

2. FOUNDATIONS:
   a. Contractor to verify locations of all underground services before excavating.

3. TIMBER:
   a. Timber seat slats to be from a sustainable source approved by CCC.
   b. Timber to be seasoned and dried to a moisture content of between 12-16%.

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**PLAN (UNDER SIDE)**

50x50x4mm Steel angle
Dressed EX. 200x50mm hardwood seat slats with 5mm chamfered edges 105 35
M10x60mm Coach bolts with 21mm dia x 1.5mm washer under nuts
17.5MPa Rapid set concrete foundation with U3 trowelled top with 10mm radius to top edges set level with existing ground R10x150mm Steel rod centrally placed on seat leg

**SIDE ELEVATION**

10mm Radius to top edges

**REAR ELEVATION**

Install to level
PLANT BED FORMATION AND EDGING ADJACENT TO GRASS AREA

NOTES:
1. Refer to SD609 for plant bed/landscaping adjacent to footpath.
**IN-GROUND RETAINING EDGE**

**NOTE:**

1) Replace edging with two 300x10mm battens where required to allow for curves.
2) Lawn may be replaced by a plant bed.

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**TIMBER RETAINING EDGE**

200x50mm H4 treated timber fixed to piles and edge batten with galvanised nails. Chamfer top edges to 5mm radius.

250x50mm H4 treated timber fixed to piles with M12 coach screws at 1m centres.

Existing ground level

600x125x125mm H4 treated timber house pile at 1.0m intervals. Set pile into concrete foundation at 2.0m intervals.

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Grass / vegetation removed

50 x 25 batten nailed to side to hold weed mat in position

Softfall as specified

Weedmat

settled depth

300

300x150 H4 treated pegs at 1m centres

1:12

New topsoil and lawn 150mm depth tapering to ground level at 1:12

300x25 batten edging

Existing ground level

500x50x50 H4 treated pegs at 1m centres

Softfall as specified

Weedmat fixed to batten edging

settled depth

300
Plant into topsoil limits of plant hole
Cutback weedmat to limits of plant hole
100mm depth specified soft fall over planted areas
300mm first class topsoil
Existing softfall top surface

PLANTING
Novaflo terminates in mulch layer with an end cap drilled with 5 holes
Grate Foundation as Specified
100mm Minimum specified Mulch

50 dia. Novaflo

Novaflo laid to encircle tree pit 100mm inside the tree pit edge

Sock constructed of Bidim A19 geotextile or similar

750mm
30% Soil Conditioner/
70% 1st Class Topsoil

600mm Structural Soil

500dia. Auger Hole depth as specified filled with Railway Ballast 57-20

L S 0 7 3 0 0 1A
1. Use vandal resistant, weather resistant, low maintenance materials e.g. galv. steel, aluminium or HS treated timber.
2. Square bollards should be used only where signs are to be attached to the bollard.
3. If Bollards are required to be removable, the method of fixing is to be approved by the Engineer.
4. Bollard colour to be traffic signal pole yellow.
5. Reflective tape to face direction of approach travel.
NOTES:
1. All measurements in millimetres.
2. All text & symbols to be 3M 'sapphire blue'.
3. Background to be Dulux 'fawn'.
4. All fonts to be Helvetica medium.
5. City Care have template for sign.
6. Mounting height 2300 to underside of sign.